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M. C. Wilson
May 30, 1903

HANDBOOK ON SANITATION.

A MANUAL OF THEORETICAL AND PRACTICAL SANITATION.

FOR STUDENTS AND PHYSICIANS; FOR HEALTH, SANITARY, TENEMENT-HOUSE, PLUMBING, FACTORY, FOOD, AND OTHER INSPECTORS; AS WELL AS FOR CANDIDATES FOR ALL MUNICIPAL SANITARY POSITIONS.

BY

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FIRST EDITION.

FIRST THOUSAND.

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TO

JACOB A. RIIS,

To whose profound knowledge of "How the Other Half Lives," deep feeling for the "Children of the Poor," and strenuous efforts in behalf of the tenement-house population of New York, a great many sanitary improvements and progress in tenement-house reform are due,

THIS BOOK IS DEDICATED IN APPRECIATION AND RESPECT

BY THE AUTHOR.

PREFACE.

In this era of intense interest in all matters relating to public health and practical sanitation, no defence is needed for the presentation of a new book on the subject, especially as the book presents the matter in a form hitherto unexploited.

Municipal Sanitation has made giant strides within the last decade; and the circle of those whose duties compel them to make a special study of sanitary questions has been considerably widened within the last few years.

The number of inspectors in the various municipal health, building, sanitary, and other similar departments, is already quite large, and the tendency is to a further augmentation of their number.

Moreover, the time when inexperienced men could be appointed as Sanitary and Health Inspectors has passed, and certain quite important and strict qualifications are required of the candidates for one of these municipal positions. These requirements and qualifications for sanitary positions are constantly being made more strict and thorough; and there is no doubt that Surgeon-General W. Wyman is right in saying: "In the sanitary progress of the new century, it has occurred

to me, there must be developed a new class of individuals in sanitary affairs." (Journal Am. Med. Asso., March, 1901.)

There are several thousand inspectors in the various sanitary municipal departments throughout the United States, and this number is being increased every year. New York City alone has added over 200 inspectors in its newly-established Tenement-house Department, which is to begin its existence January, 1902.

In spite, however, of the growing number of sanitary inspectors, the still greater number of candidates for inspectorships, and the general interest in sanitary questions, there are as yet very few sources where the desired and necessary knowledge may be gained. In England there is an extensive literature on the subject; there are dozens of special books on Sanitation, a large number of practical manuals, and a number of aids, helps, and handbooks on all sanitary subjects. Here in the United States one has to consult the several bulky text-books on hygiene intended for medical men only. Except for Dr. R. S. Tracy's little book on "Sanitary Information," and Mr. P. Gerhardt's popular books on plumbing, there are no books from which the municipal sanitary inspector, and especially the candidate for such a position, can learn what is necessary for him to know.

These were the considerations which have induced me to undertake the present work. While I do not pretend to have written a text-book on the subject of Sanitation, I hope to have succeeded in presenting the subject in a condensed and practical form, so as to enable the stu-

dent and candidate to make a creditable showing in the civil-service competitive examinations, as well as subsequently to fill one of the sanitary positions.

The first step in the study of Sanitation is to understand the principles of the science. In Part I., on Sanitary Science, I have endeavored to give a condensed but comprehensive resumé of the best text-books on the subject.

Part II. is on Sanitary Practice, upon which very little has hitherto been written from a practical standpoint. In this part are given the methods of application of sanitary science in the various municipal departments, with extracts from the laws, rules, and regulations of New York and other municipalities.

Part III. of the book relates to the inspector himself, his duties, the art of his profession, his standing, qualifications, etc.; this part also contains some useful hints which will doubtless aid him, as they will the candidate for an inspectorship.

Part IV. contains, besides the chapters on Sanitary Law and Sanitary Organization in the United States, extracts from model laws on the various branches of Sanitation.

It is right here to mention that for all information as to the laws and practice of Sanitation outside of New York, I am indebted to the new book on "Municipal Sanitation in the United States," by Dr. Chas. V. Chapin, for the publication of which all interested in Sanitation will be thankful.

I cannot close these few remarks on the scope of the book without publicly acknowledging my deep gratitude

to, and appreciation of, the assistance of those who have, in one way or another, kindly helped me in the preparation of this work.

Figure 2 in this work is from "Disposal of Household Waste," and figures 19, 20, 21 are from "House Drainage and Sanitary Plumbing," both by Mr. W. P. Gerhard, published by D. Van Nostrand Co., New York, and are here used with the kind permission of the author.

To the eminent sanitarian, Dr. Roger Sherman Tracy, I herein render my deep regard for the advice and valuable suggestions given me. My heartfelt thanks are due to my friend, Dr. Walter Brooks Brouner, for the laborious task of revising the manuscript of the book. Thanks are also due to Mr. H. Bramley and Dr. Michael B. Feeney, Chief Sanitary Inspector of the Health Department of New York City, for kindness and assistance in various ways.

Finally, I must ask the forbearance of readers for any and all inaccuracies and errors that may be found in my book, promising to correct these in any future editions of the work, if such are called for.

247 East Broadway, New York City,
October, 1901.

ERRATA.

Page 9, line 13, *for* depends *read* depend
" 12, " 5, " cloaca " cloacæ
" 17, " 15, " vitiates the air as much *read* vitiates as much air as
" 23, " 20, " Properties or diffusion *read* Properties of diffusion
" 56, " 20, " Roachdale *read* Rochedale
" 64, " 2, " takes " taking
" 123, " 20, " windows on halls, shafts, etc., is *read* windows in halls is
" 127, " 1, " gas-tight adjusted *read* adjusted gas-tight
" 129, " 3, " conditions of living in cellars *read* conditions of living in basements of new houses
" 162, " 25, " Dr. M. Betz *read* Dr. H. Betz
" 182, " 30, " he, on the contrary, gets *read* he gets
" 187, " 3, " thoroughtly *read* thoroughly
" 222, " 22, " Licurgus *read* Lycurgus
" 225, " 30, " with its 45000 Tenements *read* with its 45000 tenement-houses in Manhattan and the Bronx
" 308, " 1, " M. Betz *read* H. Betz
" 308, " 3, " 219 *read* 222

CONTENTS.

PART FIRST.—SANITARY SCIENCE.

PART SECOND.—SANITARY PRACTICE.

PART THIRD.—SANITARY INSPECTION.

PART FOURTH.—SANITARY LAW.

LIST OF ILLUSTRATIONS.

HANDBOOK ON SANITATION.

PART FIRST.

SANITARY SCIENCE.

CHAPTER I.

SOIL AND SITES.

Definition.—By the term "soil" we mean the superficial layer of the earth, a result of the geological disintegration of the primitive rock by the action of the elements upon it.

Composition.—Soil consists of solids, water, and air.

Solids.—The solid constituents of the soil are inorganic and organic in character.

The inorganic constituents are the various minerals and elements found alone or in combination in the earth, such as silica, aluminum, calcium, iron, carbon, sodium, chlorine, potassium, etc.

The characteristics of the soil depend upon its constituents, and upon the predominance of one or the other of its composing elements. The nature of the soil also depends upon its physical properties. When

the disintegrated rock consists of quite large particles, the soil is called a *gravel soil.* A *sandy soil* is one in which the particles are very small. *Sandstone* is consolidated sand. *Clay* is soil consisting principally of aluminum silicate; in *chalk* soft calcium carbonate predominates.

The organic constituents of the soil are the result of vegetable and animal growth and decomposition in the soil.

Ground-water.—Ground-water is that continuous body or sheet of water formed by the complete filling and saturation of the soil to a certain level by rain-water; it is that stratum of subterranean lakes and rivers filled up with alluvium which we reach at a higher or lower level when we dig wells.

The level of the ground-water depends upon the underlying strata, and also upon the movements of the subterranean water-bed. The relative position of the impermeable underlying strata varies in its distance from the surface-soil. In marshy land the ground-water is at the surface; in other places it can be reached only by deep borings. The source of the ground-water is the rainfall, part of which drains into the porous soil until it reaches an impermeable stratum, where it collects.

The movements of the ground-water are in two directions—horizontal and vertical. The horizontal or lateral movement is toward the seas and adjacent water-courses, and is determined by hydrostatic laws and topographical relations. The vertical motion of the ground-water is to and from the surface, and is due to

the amount of rainfall, the pressure of tides, and watercourses into which the ground-water drains. The vertical variations of the ground-water determine the distance of its surface-level from the soil-surface, and are divided into a persistently low-water level, about 15 feet from the surface; a persistently high-water level, about 5 feet from the surface, and a fluctuating level, sometimes high, sometimes low.

Ground-air.—Except in the hardest granite rocks and in soil completely filled with water, the interstices of the soil are filled with a continuation of atmospheric air, the amount depending on the degree of porosity of the soil. The nature of the ground-air differs from that of the atmosphere only as it is influenced by its location. The principal constituents of the air—nitrogen, oxygen, and carbonic acid—are also found in the ground-air, but in the latter the relative quantities of each are different.

AVERAGE COMPOSITION OF ATMOSPHERIC AIR IN 100 VOLUMES.

Nitrogen	79.00%
Oxygen	20.96%
Carbonic acid	0.04%

AVERAGE COMPOSITION OF GROUND-AIR.

Nitrogen	79.00%
Oxygen	10.35%
Carbonic acid	9.74%

Of course these quantities are not constant, but vary in different soils, and at different depths, times, etc. The greater quantity of CO_2 in ground-air is due to

the processes of oxidation and decomposition taking place in the soil. Ground-air also contains a large quantity of bacterial and other organic and gaseous matter found in the soil.

Ground-air is in constant motion, its movements depending upon a great many factors, some among these being the winds and movements of the atmospheric air; the temperature of the soil; the surface temperature; the pressure from the ground-water from below, and surface- and rain-water from above, etc.

Ground-moisture.—The interstices of the soil above the ground-water level are filled with air ONLY, when the soil is absolutely dry; but as such a soil is very rare, all soils being more or less damp, soil usually contains a mixture of air and water, or what is called *ground-moisture.*

Ground-moisture is derived partly from the evaporation of the ground-water and its capillary absorption by the surface-soil, and partly by the retention of water from rains upon the surface. The power of the soil to absorb and retain moisture varies according to the physical and chemical, as well as the thermal, properties of the soil.

Loose sand may hold about 2 gallons of water per cubic foot; granite takes up about 4% of moisture; chalk about 15%; clay about 20%; sandy loam 33 to 35%; humus about 40%.

Ground-temperature.—The temperature of the soil is due to the direct rays of the sun, the physico-chemical changes in its interior, and to the internal heat of the earth.

The ground-temperature varies according to the annual and diurnal changes of the external temperature; also according to the character of the soil, its color, composition, depth, degree of organic oxidation, ground-water level, and degree of dampness. In hot weather the surface-soil is cooler, and the subsurface-soil still more so, than the surrounding air; in cold weather the opposite is the case. The contact of the cool soil with the warm surface-air on summer evenings is what produces the condensation of air-moisture which we call dew.

Bacteria.—Quite a large number of bacteria are found in the soil, especially near the surface, where chemical and organic changes are most active. From 200,000 to 1,000,000 bacteria have been found in one c.c. of earth. The ground bacteria are divided into two groups—saprophytic and pathogenic. The saprophytic bacteria are the bacteria of decay, putrefaction, and fermentation. It is to their benevolent action that vegetable and animal débris is decomposed, oxidized, and reduced to its elements. To these bacteria the soil owes its self-purifying capacity and the faculty of disintegrating animal and vegetable débris.

The pathogenic bacteria are either those formed during the process of organic decay, and which, introduced into the human system, are capable of producing various diseases, or those which become lodged in the soil through the contamination of the latter by ground-water and air, and which find in the soil a favorable culture-medium, until forced out of the soil by the movements of the ground-water and air.

Contamination of the Soil.—The natural capacity of the soil to decompose and reduce organic matter is sometimes taxed to its utmost by the introduction into the soil of extraneous matters in quantities which the soil is unable to oxidize in a given period. This is called contamination or pollution of soil, and is due:

1) to surface pollution by refuse, garbage, animal, and human excreta;

2) to interment of dead bodies of beasts and men;

3) to the introduction of foreign deleterious gases, etc.

Pollution by Surface Refuse and Sewage.—This occurs where a large number of people congregate, as in cities, towns, etc., and very seriously contaminates the ground by the surcharge of the surface-soil with sewage matter, saturating the ground with it, polluting the ground-water from which the drinking-water is derived, and increasing the putrefactive changes taking place in the soil. Here the pathogenic bacteria abound, and, by multiplying, exert a very marked influence upon the health, and cause the various infectious diseases. Sewage pollution of the soils and of the source of water-supply is a matter of grave importance, and is one of the chief factors of high mortality in cities and towns.

Interment of Bodies.—The second cause of soil contamination is also of great importance. Owing to the intense physico-chemical and organic changes taking place within the soil, all dead-animal matter interred therein is easily disposed of in a certain time, being reduced to more or less common elements, viz., ammonia, nitrous acid, carbonic acid, sulphuretted and

carburetted hydrogen, etc. But whenever the number of interred bodies is too great, and the products of decomposition are allowed to accumulate to a very great degree, until the capacity of the soil to absorb and oxidize them is overtaxed, the soil, and the air and water therein, are polluted by the noxious poisons produced by the processes of decomposition.

Introduction of Various Foreign Materials and Gases.—In cities and towns various pipes are laid in the ground for conducting certain substances, as illuminating gas, fuel coal-gas, etc.; the pipes at times are defective, allowing leakage therefrom, and permitting the saturation of the soil with poisonous gases which are frequently drawn up by the various currents of ground-air into the open air and adjacent dwellings.

Influence of the Soil on Health.—The intimate relations existing between the soil upon which we live and our health, and the marked influence of the soil on the life and well-being of man, have been recognized from time immemorial.

The influence of the soil upon health is due to:

1) the physical and chemical character of the soil;

2) the ground-water level and degree of dampness;

3) the organic impurities and contamination of the soil.

The physical and chemical nature of the soil, irrespective of its water, moisture, and air, has been found to produce a certain marked effect on the health, growth, and constitution of man. The peculiar disease called cretinism, as well as goitre, has been traced directly to a certain chemical composition of the soil.

The ground-water level is of great importance to the well-being of man. It has been definitely ascertained that a persistently low-water level (about 15 feet from the surface) is healthy, the mortality being the lowest in such places; a persistently high ground-water level (about 5 feet from the surface) is unhealthy; and a fluctuating level, varying from high to low, is the most unhealthy, and is dangerous to life and health. Malaria and other paroxysmal fevers, tuberculosis, rheumatism, neuralgias, etc., were traced directly to a high-water level and marshy ground.

A damp soil, viz., a soil wherein the ground-moisture is very great and persistent, has been found inimical to the health of the inhabitants, favoring the development of various diseases by the direct effect of the dampness itself, and by the greater proneness of damp ground to become contaminated with various pathogenic bacteria and organisms which may be drawn into the dwellings by the movements of the ground-air. As a rule there is very little to hinder the ground-air from penetrating the dwellings of man, air being drawn in through cellars by changes in temperature, and by the artificial heating of houses.

The organic impurities and bacteria found in the soil are especially abundant in large cities, and are a great cause of the evil influence of soil upon health. The impurities are allowed to drain into the ground, to pollute the ground-water and the source of water-supply, and to poison the ground-air, loading it with bacteria and products of putrefaction, thus playing havoc with the health of human beings.

Diseases due to Soil.—A great many diseases have been traced directly or indirectly to the influence of the soil. The manner in which these diseases are contracted has not been as yet clearly proven in all cases. The following diseases have been mentioned as traceable to soil influences: Malaria, Paroxysmal Fevers, Tuberculosis, Neuralgias, Cholera, Yellow Fever, Bubonic Plague, Typhoid, Dysentery, Goitre and Cretinism, Tetanus, Anthrax, Malignant Œdema, Septicæmia, etc.

Sites.—From what we have already learned about the soil, it is evident that it is a matter of great importance as to where a site for a human habitation is selected, for upon the proper selection of the site depends the health, well-being, and longevity of the inhabitants. The requisite characteristics of a healthy site for dwellings are: A dry, porous, permeable soil; a low and non-fluctuating ground-water level, and a soil retaining very little dampness, free from organic impurities, and the ground-water of which is well drained into distant watercourses, while its ground-air is uncontaminated by pathogenic bacteria. Exposure to sunlight, and free circulation of air, are also requisite.

According to Parkes, the soils in the order of their fitness for building purposes are as follows: 1) primitive rock; 2) gravel with pervious soil; 3) sandstone; 4) limestone; 5) sandstone with impervious subsoil; 6) clays and marls; 7) marshy land; and 8) made soils.

It is very seldom, however, that a soil can be secured having all the requisites of a healthy site. In smaller places, as well as in cities, commercial and other reasons frequently compel the acquisition of and building upon

a site not fit for the purpose; it then becomes a sanitary problem how to remedy the defects and make the soil suitable for habitation.

Prevention of the Bad Effects of the Soil on Health.—The methods taught by sanitary science to improve a defective soil and to prepare a healthy site are following:

1) Street-paving and tree-planting.
2) Proper construction of houses.
3) Subsoil drainage.

Street-paving serves a double sanitary purpose. It prevents street-refuse and sewage from penetrating the ground and contaminating the surface-soil, and it acts as a barrier to the free ascension of deleterious ground-air.

Tree-planting acts as a factor in absorbing the ground-moisture and in oxidizing organic impurities.

The Proper Construction of the House has for its purpose the prevention of the entrance of ground-moisture and air inside the house by building the foundations and cellar in such a manner as to entirely cut off communication between the ground and the dwelling. This is accomplished by putting under the foundation a solid bed of concrete, and under the foundation-walls damp-proof courses. By cementing the cellar with a proper cement of suitable thickness, dampness and ground-air are prevented from entering.

Subsoil drainage.—By subsoil drainage is meant the reducing of the level of the ground-water by draining all subsoil water into certain watercourses, either artificial or natural. Subsoil drainage is not a modern dis-

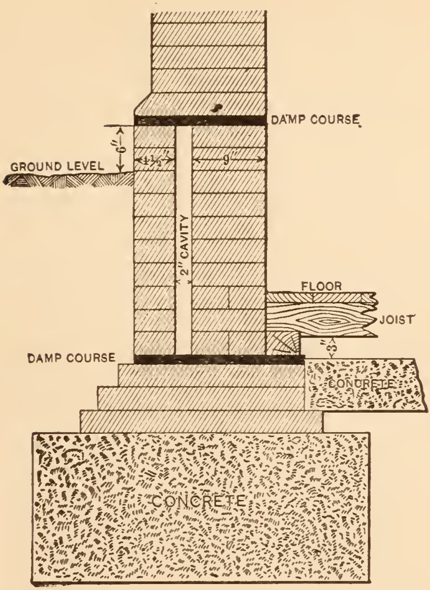


FIG. 1.—CONCRETE FOUNDATION AND DAMP-PROOF COURSE. (TAYLOR.)

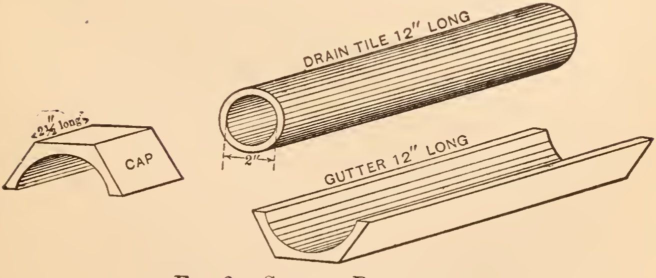


FIG. 2.—SUBSOIL DRAIN-PIPES.

covery, as it was used in many ancient lands, and was extensively employed in ancient Rome, the valleys and suburbs of which would have been uninhabitable but for the draining of the marshes by the so-called "cloaca" or drains, which lowered the ground-water level of the low parts of the city and made them fit to build upon. The drains for the conduction of subsoil water are placed at a certain depth, with a fall toward the exit. The materials for the drain are either stone and gravel trenches, or, better, porous earthenware pipes or ordinary drain-tile. The drains must not be impermeable or closed, and sewers are not to be used for drainage purposes. Sometimes open V-shaped pipes are laid under the regular sewers, if these are at the proper depth.

By subsoil drainage it is possible to lower the level of ground-water wherever it is near or at the surface, as in swamps, marsh, and other lands, and prepare lands previously uninhabitable for healthy sites.

CHAPTER II.

AIR.

Composition.—The composition of atmospheric air is quite uniform, and is as follows in 100 volumes:

Nitrogen	79.00%
Oxygen	20.96%
Carbonic acid	00.04%

Ozone, traces of ammonia, aqueous vapor, suspended solids, and variable gases.

Nitrogen.—The quantity of this constituent is invariable. Its function seems to be that of a diluent of the oxygen, and as a participant in the various chemical processes of vegetable life.

Oxygen varies in quantity but very little, from 20.98% in pure mountain air to 20.87% in the air of cities. The greatest variation exists between inspired and expired air. In expired air the volume of oxygen present is 16.03%, as compared with the 20.87% in city air. Oxygen is the most important of all the air constituents. Light, heat, growth, and life itself, are due to the oxygen in the air, without which vegetable, animal, and human life would be extinct, and the earth cold, barren, and lifeless. When the relative quantity

of oxygen in the air falls below 8%, animals cannot breathe, but become asphyxiated.

Carbonic acid or CO_2 (its chemical formula) is found in the air in the small average quantity of 0.04%, or 4 parts in 10,000; the greatest quantity in confined spaces after the air has been breathed by people is 0.06%.

Carbonic acid is the product of organic decomposition and oxidation, and is indispensable to vegetable life, which absorbs it and exhales oxygen. The carbonic acid content of air is taken as the standard of air impurity.

Ozone, argon, and ammonia are found in very minute quantities, and their functions are not as yet definitely determined.

Humidity, Temperature, and Pressure.—The atmosphere is never entirely dry, there always being a relative amount of aqueous vapor, varying from 30% to 100%, or saturation. The relative proportions of aqueous vapor determine the degree of humidity, 65–75% being regarded as the most beneficial to health. The warmth of the air is derived from the rays of the sun, according to the intensity of which the temperature varies. The atmosphere extends from the surface to an indefinite height, and, according to the law of gravitation, presses downward with a certain force. This force, called atmospheric pressure, varies according to the temperature and relative humidity of the air, a warmer air being lighter, a cold air heavier, and a dry air weighing less than a damp air. These differences in relative pressure, temperature, and hu-

midity produce the constant motion of the air, called "wind."

Impurities in Air.—The atmosphere surrounds our earth, participates in its life, and is charged with débris and particles of mineral, vegetable, and animal life of the earth. By the action of gravitation and winds the suspended matters and gases are scattered and diffused, fall to the earth again, and are there digested, worked over, and oxidized in the great laboratory of Nature.

The impurities in air, according to their substance and character, are as follows: Mineral, Vegetable, Animal, Bacteria, and Gases.

The mineral substances found in the air are the particles of soil, such as silica, sand, chalk, iron, lead, arsenic, zinc, copper, etc.

The vegetable substances are carbon, fibres and cells, starch, grains, cotton, moulds, fungi, pollen, etc.

The animal substances are either the débris from the various living and dead animals, or the microscopic animalculi suspended in the air. The following are some of the animal particles found in air: wool, silk fibres, human hair, epithelial cells, fragments of insects, pus cells, molecular débris, and the various micro-organisms.

The bacteria in the air are either saprophytic or pathogenic, and their number varies from 0 in pure mountain air to 79,000 per cubic metre in the air of Paris.

The gaseous impurities of the air are the various compounds of carbon (carbon monoxide and dioxide), of hydrogen (sulphuretted and carburetted), of nitro-

gen (ammonia, ammonia acetate, sulphide, nitrous and nitric acids), of sulphur, etc.

Impurities According to their Source.—According to their source the impurities in the air are:

Impurities due to respiration.

Impurities due to organic decomposition.

Impurities due to combustion.

Impurities due to various trades.

Impurities Due to Respiration.—The expired air from the lungs of man or beast is poorer in oxygen by about 4%, and richer in CO_2 by a similar quantity—4%. This increase in the CO_2 is not of much importance when in the free air, for any excess of one gas is speedily reduced; in confined spaces, however, the air which has been expired is soon laden with CO_2 until it becomes unfit for further respiration. Besides the increased CO_2, respired air contains the organic exhalations which go hand in hand with the increase of CO_2. This organic matter, which vitiates the air and renders it malodorous and offensive, is a product of nitrogenous animal decomposition; it yields ammonia, darkens sulphuric acid, decolorizes potassium permanganate, and is, together with the decrease of O and increase of CO_2, the cause of the poisonous action which unventilated rooms and places have upon people. That a room in which the respired air is unchanged is directly poisonous, has been proved over and over again; and the oft-quoted Black Hole of Calcutta, in which 123 out of 146 people died within 10 hours, is cited as an example.

Organic Decomposition is a prolific source of air im-

purity. Of the organic human effluvia, we have already spoken; air is, however, largely vitiated by the emanation of the various decomposition products of organic matter, *e.g.*, the effete products of man and beast, such as urine, sewage, and other excrementitious matter. The atmosphere of cities is constantly contaminated with the effluvia from soil, ground-air, sewer-gases, etc.

Combustion is also a very important source of air vitiation. The products of coal and wood combustion are carbon monoxide and dioxide, CO and CO_2, various sulphur compounds, and a large quantity of soot and tarry matter. Illumination by oil, candles, gas, etc., is also a source of various impurities. Every cubic foot of gas burnt per hour vitiates the air as much as would be rendered impure by one individual. The electric light is the only illuminant that does not add impurities to the air.

In certain *trades* a large amount of dust and also of various chemical substances and gases are produced which render the air in and about said places impure.

Influence of Air on Health.—That the air, without which we cannot live more than a few minutes, has a great influence on the health of man, is self-evident. The physical condition of the air, the temperature, pressure, humidity, motion, relative content of one or the other of its constituents, the degree of vitiation, and the impurities in the air, all have a marked influence on the health, life, and longevity of man.

Diseases Due to Impure Air.—Impure air has a directly bad effect on health, and is capable of producing

certain diseases. These diseases are due to the direct or indirect effects of the various impurities found in the air; impurities which have a very detrimental influence upon the respiratory, digestive, and general functions of the body.

CO_2 when habitually inhaled in small amounts causes malaise, headache, debility; in large amounts it is a virulent poison.

The products of organic decomposition, sewer-gas, and the many pathogenic bacteria which abound and multiply in decomposed organic matter, are all capable of producing various infectious and other diseases.

Carbon monoxide and the other products of combustion and illumination cause, when constantly inhaled, various respiratory and constitutional diseases, and may produce death when inhaled in large amounts.

The mechanical and chemical impurities which are produced during and in the process of the various manufactures and trades are the direct cause of many of the diseases of those employed in those trades. Altogether we can truthfully say that there is hardly a disease which is not directly or indirectly caused by the impurities found in the air.

CHAPTER III.

VENTILATION.

Definition.—The air within an uninhabited room does not differ from that without. If the room is occupied by one or more individuals, however, then the air in the room soon deteriorates, until the impurities therein reach a certain degree incompatible with health. This is due to the fact that with each breath a certain quantity of CO_2, organic impurities, and aqueous vapor is exhaled; and these products of respiration soon surcharge the air until it is rendered impure and unfit for breathing. In order to render the air pure in such a room, and make life possible, it is necessary to change the air by withdrawing the impure, and substituting pure air from the outside. This is *ventilation.*

Ventilation, therefore, is the maintenance of the air in a confined space in a condition conducive to health; in other words, "ventilation is the replacing of the impure air in a confined space by pure air from the outside."

Quantity of Air Required.—What do we regard as impure air? What is the index of impurity? How much air is required to render pure an air in a given space, in a given time, for a given number of people?

How often can the change be safely made, and how? These are the problems of ventilation.

An increase in the quantity of CO_2, and a proportionate increase of organic impurities, are the results of respiratory vitiation of the air; and it has been agreed to regard the relative quantity of CO_2 as the standard of impurity, its increase serving as an index of the condition of the air. We have seen that the normal quantity of CO_2 in the air is 0.04%, or 4 volumes in 10,000; and it has been determined that whenever the CO_2 reaches 0.06%, or 6 parts per 10,000, the maximum of air vitiation is reached—a point beyond which the breathing of the air becomes dangerous to health.

We therefore know that an increase of 2 volumes of CO_2 in 10,000 of air constitutes the maximum of admissible impurity; the difference between 0.04% and 0.06%. Now, a healthy average adult at rest exhales in one hour 0.6 cubic foot of CO_2. Having determined these two factors—the amount of CO_2 exhaled in one hour and the maximum of admissible impurity—we can find by dividing 0.6 by 0.0002 (or 0.02 per cent.) the number of cubic feet of air needed for one hour, = 3000.

Therefore, a room with a space of 3000 cubic feet, occupied by one average adult at rest, will not reach its maximum of impurity (that is, the air in such a room will not be in need of a change) before one hour has elapsed.

The relative quantity of fresh air needed will differ for adults at work and at rest, for children, women, etc.;

it will also differ according to the illuminant employed, whether oil, candle, gas, etc.—an ordinary 3-foot gas-burner requiring 1800 cubic feet of air in one hour.

It is not necessary, however, to have 3000 cubic feet of space for each individual in a room, for the air in the latter can safely be changed at least three times within one hour, thus reducing the air-space needed to about 1000 cubic feet. This change of air or ventilation of a room can be accomplished by mechanical means oftener than three times in an hour, but a natural change of more than three times in an hour will ordinarily create too strong a current of air, and may cause draughts and chills dangerous to health.

In determining the cubic space needed, the height of the room as well as the floor-space must be taken into consideration. As a rule the height of a room ought to be about one-third of the cubic space, and in ordinary rooms should not exceed 12 feet, as a height beyond that is of very little advantage.

Forces of Ventilation.—We now come to the question of the various modes by which change in the air of a room is possible. Ventilation is natural or artificial according to whether artificial or mechanical devices are or are not used. Natural ventilation is only possible because our buildings and houses, their material and construction, are such that numerous apertures and crevices are left for air to come in; for it is evident that if a room were hermetically air-tight, no ventilation would be possible.

The properties of air which render both natural and artificial ventilation possible are diffusion, motion,

and gravity. These three forces are the natural agents of ventilation.

There is a constant diffusion of gases taking place in the air; this diffusion takes place even through stone walls and through brick. The more porous the material of which the building is constructed, the more readily does diffusion take place. Dampness, plastering, painting, and papering of walls diminish diffusion, however.

The second force in ventilation is the motion of air, or winds. This is the most powerful agent of ventilation, for even a slight, imperceptible wind travelling about two miles an hour is capable, when the windows and doors of a room are open, of changing the air of a room 528 times in one hour. Air passes also through brick and stone walls. The objections to winds as a sole mode of ventilation are their inconstancy and irregularity. When the wind is very slight, its ventilating influence is very small; on the other hand, when the wind is strong, it cannot be utilized as a means of ventilation on account of the air-currents being too strong and capable of exerting deleterious effects on health.

The third, the most constant and reliable, and, in fact, principal agent of ventilation, is the specific gravity of the air, and the variations in the gravity and consequent pressure which are results of the variations in temperature, humidity, etc. Whenever air is warmer in one place than in another, the warmer air being lighter and the colder air outside being heavier, the latter exerts pressure upon the air in the room, causing the lighter air in the room to escape and be displaced by the heavier air from the outside, thus chang-

ing the air in the room. This mode of ventilation is always constant and at work, as the very presence of living beings in the room warms the air therein, thus causing a difference from the outside air and effecting change of air from the outside to the inside of the room.

Methods of Ventilation.—The application of these principles of ventilation is said to be accomplished in a natural or an artificial way, according as mechanical means to utilize the forces and properties of air are used or not. But in reality natural ventilation can hardly be said to exist, since dwellings are so constructed as to guard against exposure and changes of temperature, and are usually equipped with numerous appliances for promoting change of air. Windows, doors, fire-places, chimneys, shafts, courts, etc., are all artificial methods of securing ventilation, although we usually regard them as means of natural ventilation.

Natural Ventilation.—The means employed for applying the properties or diffusion are the materials of construction. A porous material being favorable for diffusion, some such material is placed in several places within the wall, thus favoring change of air. Imperfect carpenter-work is also a help, as the cracks and openings left are favorable for the escape and entrance of air.

Wind, or the motion of air, is utilized either directly, through windows, doors, and other openings; or indirectly, by producing a partial vacuum in passing over chimneys and shafts, causing suction of the air in them and the consequent withdrawal of the air from the rooms.

The opening of windows and doors is possible only in warm weather; and as ventilation becomes a problem only in temperate and cold weather, the opening of windows and doors cannot very well be utilized without causing colds, etc. Various methods have therefore been proposed for using windows for the purposes of ventilation without producing forcible currents of air.

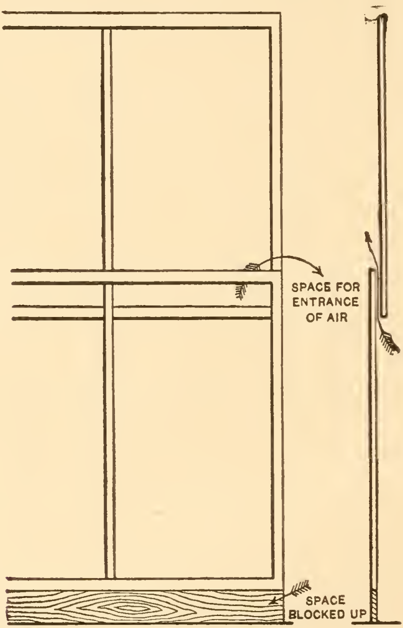


FIG. 3.—HINKES BIRD WINDOW. (TAYLOR.)

The part of the window best fitted for the introduction of air is the space between the two sashes, where they meet. The ingress of air is made possible whenever the lower sash is raised or the upper one is lowered.

In order to prevent cold air from without entering through the openings thus made, it has been proposed by Hinkes Bird to fit a block of wood in the lower opening; or else, as in Dr. Keen's arrangement, a piece of paper or cloth is used to cover the space left by the lifting or lowering of either or both sashes. Louvers or inclined panes or parts of these may also be used. Parts or entire window-panes are sometimes wholly removed and replaced by tubes or perforated pieces of zinc, so that air may come in through the apertures. Again,

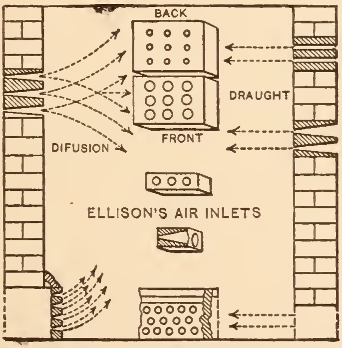


FIG. 4. (KNIGHT.)

apertures for inlets and outlets may be made directly in the walls of the rooms. These openings are filled in with porous bricks or with specially made bricks (like Ellison's conical bricks), or boxes provided with several openings. A very useful apparatus of this kind is the so-called Sherringham valve, which consists of an iron box fitted into the wall, the front of the box facing the room having an iron valve hinged along its lower edge, and so constructed

that it can be opened or be closed at will to let a current of air pass upward. Another very good appa-

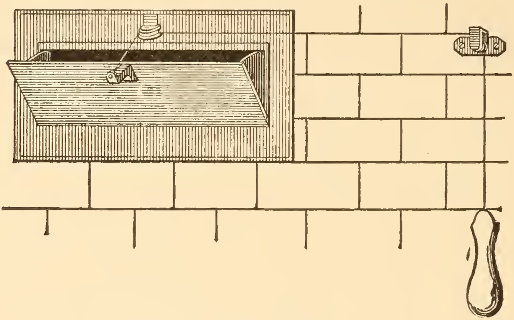


FIG. 5.—SHERRINGHAM VALVE. (TAYLOR.)

ratus of this kind is the Tobin ventilator, consisting of horizontal tubes let through the walls, the outer ends

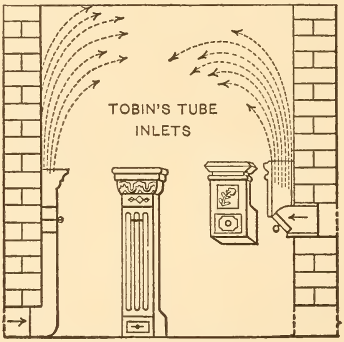


FIG. 6. (KNIGHT.)

open to the air, but the inner ends projecting into the room, where they are joined by vertical tubes carried up 5 feet or more from the floor, thus allowing the outside air to enter upwardly into the room. This plan is

also adapted for filtering and cleaning the incoming air by placing cloth or other material across the lumen of the horizontal tubes to intercept dust, etc. McKinnell's ventilator is also a useful method of ventilation, especially of underground rooms.

To assist the action of winds over the tops of shafts

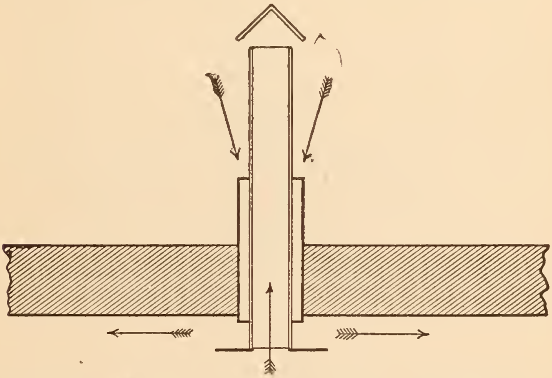


FIG. 7.—MCKINNELL'S VENTILATOR. (TAYLOR.)

and chimneys, various cowls have been devised. These cowls are arranged so as to help aspirate the air from the tubes and chimneys, and prevent a down-draught.

The same inlets and outlets which are made to utilize winds may also be used for the ventilation effected by the motion of air due to difference in the specific gravity of outside and inside air. Any artificial warming of the air in the room, whether by illuminants or by the various methods of heating rooms, will aid in ventilating it, the chimneys acting as powerful means of removal for the warmer air. Various methods have also been proposed for utilizing the chimney, even when no

stoves, etc., are connected with it, by placing a gaslight within the chimney to cause an up-draught and consequent aspiration of the air of the room through it.

The question of the number, relative size, and position of the inlets and outlets is a very important one,

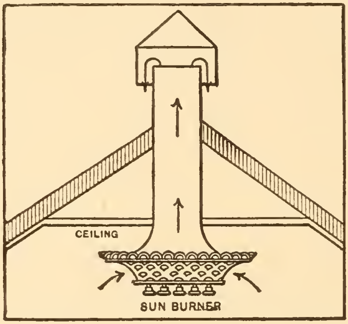


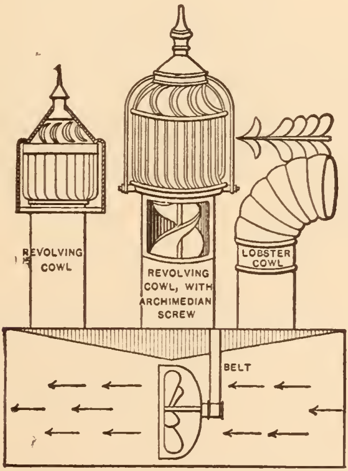
Fig. 8. (Knight.)

but we can here give only an epitome of the requirements.

The inlet and outlet openings should be about 24 inches square per head. Inlet openings should be short, easily cleaned, sufficient in number to insure a proper distribution of air; should be protected from heat, provided with valves so as to regulate the inflow of air, and, if possible, should be placed so as to allow the air passing through them to be warmed before entering the room. Outlet openings should be placed near the ceiling, should be straight and smooth, and, if possible, should be heated so as to make the air therein warmer, thus preventing a down-draught, as is frequently the case when the outlets become inlets.

Artificial Ventilation.—Artificial ventilation is accomplished either by aspirating the air from the building, known as the vacuum or extraction method, or by forcing into the building air from without; this is known as the plenum or propulsion method.

The extraction of the air in a building is done by



FAN EXTRACTING AND PROPELLING AIR

Fig. 9.—Cowl Ventilators. (Knight.)

means of heat, by warming the air in chimneys or special tubes, or by mechanical means with screws or fans run by steam or electricity; these screws or fans revolve and aspirate the air of the rooms, and thus cause pure air to enter.

The propelling method of ventilation is carried out by mechanical means only, air being forced in from the outside by fans, screws, bellows, etc.

Artificial ventilation is applicable only where a large volume of air is needed, and for large spaces, such as theatres, churches, lecture-rooms, etc. For the ordi-

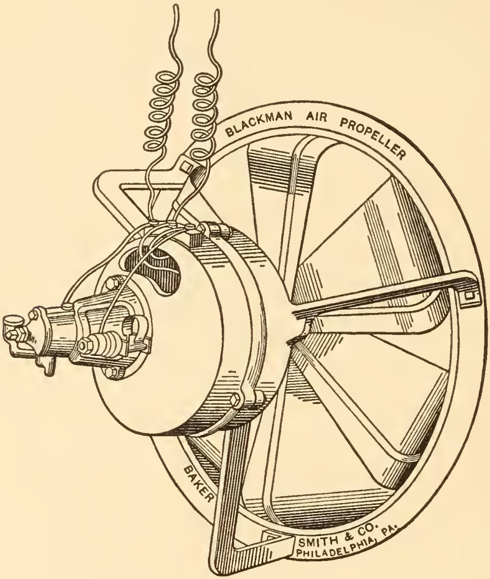


FIG. 10.

nary building the expense for mechanical contrivances is too high.

On the whole, ventilation without complex and cumbersome mechanisms is to be preferred.

CHAPTER IV.

WARMING.

Ventilation and Heating.—The subject of the heating of our rooms and houses is very closely allied to that of ventilation, not only because both are a special necessity at the same time of the year, but also because we cannot heat a room without at the same time having to ventilate it, by providing an egress for the products of combustion and introducing fresh air to replace the vitiated.

Need of Heating.—In a large part of the country, and during the greater period of the year, some mode of artificially heating rooms is absolutely necessary for our comfort and health. The temperature of the body is 98° to 99° F., and there is a constant radiation of heat due to the cooling of the body surface. If the external temperature is very much below that of the body, and if the low temperature is prolonged, the radiation of heat from the body is too rapid, and colds, pneumonia, etc., result. The temperature essential for the individual varies according to age, constitution, health, environment, occupation, etc. A child, a sick person, or one at rest requires a relatively higher temperature than a healthy adult at work. The mean tem-

perature of a room most conducive to the health of the average person is from 65° to 75° F.

The Three Methods of Heating.—The heating of a room can be accomplished either *directly* by the rays of the sun or processes of combustion. We thus receive *radiant* heat, exemplified by that of open fires and grates.

Or, the heating of places can be accomplished by the heat of combustion being conducted through certain materials, like brick walls, tile, stone, and also iron; this is *conductive* heat, as afforded by stoves, etc.

Or, the heat is *conveyed* by means of air, water, or steam from one place to another, as in the hot-water, hot-air, and steam systems of heating; this we call *convected* heat.

There is no strict line of demarcation differentiating the three methods of heating, as it is possible that a radiant heat may at the same time be conductive as well as convective—as is the case in the Galton fire-place, etc.

Materials of Combustion.—The materials of combustion are air, wood, coal, oil, and gas. Air is indispensable, for, without oxygen, there can be no combustion. Wood is used in many places, but is too bulky and expensive. Oil is rarely used as a material of combustion, its principal use being for illumination. Coal is the best and cheapest material for combustion. The chief objection against its use is the production of smoke, soot, and of various gases, as CO, $C0_2$, etc. Gas is a very good, in fact, the best material for heating,

especially if, when used, it is connected with chimneys; otherwise it is objectionable, as it burns up too much air, vitiates the atmosphere, and the products of combustion are deleterious; it is also quite expensive. The ideal means of heating is electricity.

Chimneys.—All materials used for combustion yield products more or less injurious to health. Every system of artificially heating houses must therefore have not only means of introducing fresh air to aid in the burning up of the materials, but also an outlet for the vitiated, warmed air, partly charged with the products of combustion. These outlets are provided by chimneys. Chimneys are hollow tubes or shafts built of brick and lined with earthen pipes or other material inside. These tubes begin at the lowest fireplace or connection, and are carried up several feet above the roof. The thickness of a chimney is from 4 to 9 inches; the shape square, rectangular, or preferably circular. The diameter of the chimney depends upon the size of the house, the number of fire-connections, etc. It should be neither too small nor too large. Square chimneys should be 12 to 16 inches square; circular ones from 6 to 8 inches in diameter for each fire-connection. The chimney consists of a *shaft*, or vertical tube, and *cowls* placed over chimneys on the roof to prevent down-draughts and the falling in of foreign bodies. That part of the chimney opening into the fireplace is called the *throat*.

Smoky Chimneys.—A very frequent cause of complaint in a great many houses is the so-called "smoky chimney"; this is the case when smoke and coal-gas es-

cape from the chimney and enter the living rooms. The principal causes of this nuisance are:

1) A too wide or too narrow diameter of the shafts. A shaft which is too narrow does not let all the smoke escape; one which is too wide lets the smoke go up only in a part of its diameter, and when the smoke meets a counter-current of cold air it is liable to be forced back into the rooms.

2) The throat of the chimney may be too wide, and will hold cold air, preventing the warming of the air in the chimneys and the consequent up-draught.

3) The cowls may be too low or too tight, preventing the escape of the smoke.

4) The brickwork of the chimney may be loose, badly constructed, or broken into by nails, etc., thus allowing smoke to escape therefrom.

5) The supply of air may be deficient, as when all doors and windows are tightly closed.

6) The chimney may be obstructed by soot or some foreign material.

7) The wind above the house may be so strong that its pressure will cause the smoke from the chimney to be forced back.

8) If two chimneys rise together from the same house, and one is shorter than the other, the draught of the longer chimney may cause an inversion of the current of air in the lower chimney.

9) Wet fuel when used will cause smoke by its incomplete combustion.

10) A chimney without a fire may suck down the smoke from a neighboring chimney; or, if two fire-

places in different rooms are connected with the same chimney, the smoke from one room may be drawn into the other.

Methods of Heating. Open Fire-places and Grates.—Open fire-places and fires in grates connected with chimneys, and using coal, wood, or gas, are very comfortable; nevertheless there are weighty objections to them. Firstly, but a very small part of the heat of the material burning is utilized, only about 12% being radiated into the room, the rest going up the chimney. Secondly, the heat of grates and fire-places is only local, being near the fires and warming only that part of the person exposed to it, leaving the other parts of the room and person cold. Thirdly, the burning of open fires necessitates a great supply of air, and causes powerful draughts.

The open fire-place can, however, be greatly improved by surrounding its back and sides by an air-space, in which air can be warmed and conveyed into the upper part of the room; and if a special air-inlet is provided for supplying the fire with fresh air to be warmed, we get a very valuable means of heating. These principles are embodied in the Franklin and Galton grates. A great many other grates have been suggested, and put on the market, but the principal objection to them is their complexity and expense, making their use a luxury not attainable by the masses.

Stoves.—Stoves are closed receptacles in which fuel is burned, and the heat produced is radiated towards the persons, etc., near them, and also conducted through the iron or other materials of which the stoves are made

to surrounding objects. In stoves 75% of the fuel burned is utilized. They are made of brick, tile, and cast or wrought iron.

Brick stoves, and stoves made of tile, are extensively used in some European countries, as Russia, Germany,

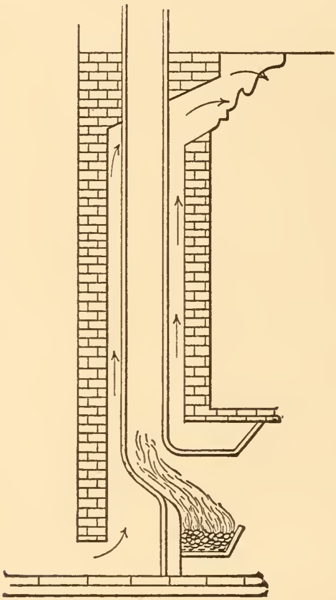


FIG. 11.—GALTON GRATE. (TRACY.)

Sweden, etc.; they are made of slow-conducting material, and give a very equable, efficient, and cheap heat, although their ventilating power is very small.

Iron is used very extensively because it is a very good conductor of heat, and can be made into very convenient forms. Iron stoves, however, are liable to become superheated, dry up, and sometimes burn the air

around them, and produce certain deleterious gases during combustion. When the fire is confined in a clay fire-box, and the stove is not overheated, a good supply of fresh air being provided and a vessel of water placed

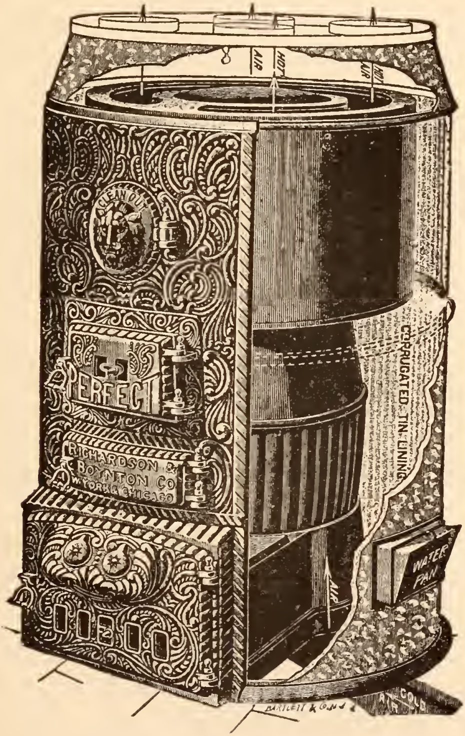


FIG. 12.—HOT-AIR FURNACE.

on the stove to reduce the dryness of the air, iron stoves are quite efficient.

Hot-air Warming.—In small houses the warming of the various rooms and halls can be accomplished by

placing the stove or furnace in the cellar, heating a large quantity of air and conveying it through proper tubes to the rooms and places to be warmed. The points to be observed in a proper and efficient hot-air heating system are the following:

1) The furnace must be of a proper size in proportion to the area of space to be warmed. 2) The joints and parts of the furnace must be gas-tight. 3) The furnace should be placed on the cold side of the house, and provision made to prevent cellar-air from being drawn up into the cold-air box of the furnace. 4) The air for the supply of the furnace must be gotten from outside, and the source must be pure, above the ground-level, and free from contamination of any kind. 5) The cold-air box and ducts must be clean, protected against the entrance of vermin, etc., and easily cleaned. 6) The air should not be overheated. 7) The hot-air flues or tubes must be short, direct, circular, and covered with asbestos or some other non-conducting material.

Hot-water System.—The principles of hot-water heating are very simple. Given a circuit of pipe filled with water, on heating the lower part of the circuit, the water, becoming warmer, will rise, circulate, and heat the pipes in which it is contained, thus warming the air in contact with the pipes. The lower part of the circuit of pipe begins in the furnace or heater, and the other parts of the circuit are conducted through the various rooms and halls throughout the house to the uppermost story. The pipes need not be straight all through; hence, to secure a larger area for

heating, they are convoluted within the furnace, and also in the rooms, where the convoluted pipes are called *radiators.* The water may be warmed by the low- or high-pressure system; in the latter a pipe of small diameter can be employed, while in the former pipes of a large diameter will be required. The character, etc., of the boilers, furnace, pipes, etc., cannot be gone into here.

Steam-heating System.—The principle of steam heating does not differ from that of the hot-water system. Here the pressure is greater and steam is employed instead of water. The steam gives a greater degree of heat, but the pipes must be stronger and able to withstand the pressure. There are also combinations of steam and hot-water heating. For large houses either steam or hot-water heating is the best means of warming, and, if properly constructed and cared for, quite healthy.

CHAPTER V.

WATER.

Composition.—Water is a compound of two elements: Hydrogen and Oxygen, united in the proportion of 2 volumes of the former to 1 of the latter; its chemical formula is H_2O.

Quantity Required.—Owing to the many uses to which water is put, a large quantity is needed. The quantity varies according to the people and their degree of civilization, according to place, supply, etc. The average quantity of water needed for all purposes has been estimated to be about 50 gallons per head per day. Most of the cities furnish a larger supply, however.

Characteristics and Quality of Water.—Water for drinking purposes must be clear, colorless, and without taste or odor; it should be aerated and free from impurities. Water is a powerful solvent, and therefore, in a state of nature, contains a great number of elements, compounds, and gases in solution as well as in suspension. The taste of water depends upon its source, character, substances present, gases, etc. When water contains a large quantity of calcium bicarbonate and magnesium salts, it is called *hard*. Soft water is

better than hard for washing and cooking purposes, as well as for production of steam, hard water causing much trouble by forming incrustations within pipes and boilers. Not every palatable water is wholesome, as sometimes a palatable, sparkling water is due to excess of CO_2 produced by pollution with organic matter. Rain-water, when uncontaminated, is the purest and most wholesome, but it is not very palatable owing to its being unaerated.

Source.—All water is derived primarily from the precipitation of aqueous vapor in form of rain, snow, and dew.

The sources of water are:

1) Rain-water,—collected immediately after falling, and stored for future use.

2) Surface-water,—found in lakes, rivers, and ponds.

3) Ground-water,—obtained from springs and wells.

According to the Report of the River-Pollution Commission, waters are:

Wholesome..	Spring-water,	very palatable.
	Deep well-water,	
	Upland surface-water,	moderately palatable.
Suspicious...	Stored rain-water,	
	Surface-water from cultivated land,	palatable.
	River-water contaminated with sewage,	
	Shallow well-water,	

Impurities.—Absolutely pure water can only be found in the laboratory in the form of distilled water, immediately after its condensation; otherwise water, being a powerful solvent, will take up foreign materials and gases with which it may come in contact. Rain is the

purest water found in nature, but in its transit through the air it takes up suspended impurities, and when it reaches the ground it is already contaminated by those impurities. The impurities found in water are classified according to their character: mineral, vegetable, animal, bacterial, and gaseous; or according to their source, character of the soils, and contamination of the water due to the methods of its collection, storage, distribution, etc.

Pollution.—Owing to the fact that water takes up most inorganic and organic matters, it is often polluted by various poisonous materials, metals, organic impurities, and pathogenic bacteria with which it comes in contact on passing from its various sources, through the soil, surface-air, ground-water, etc. The sources of water-supply, especially within the soil and also on the surface, such as rivers and lakes, are prone to be contaminated by sewage, refuse, bacteria, and other impurities, and the water derived from these sources may take up any or all of these impurities.

Influence on Health and Diseases Due to Impure Water.—Next to air, water is most indispensable to life and health; and the lack of water, or a supply of water contaminated by impurities, naturally exerts a great influence on health. A deficient supply for drinking purposes will cause failing health, and a lack of water for body cleansing and flushing purposes will impair the health and predispose to various diseases. The impurities contained in water are capable of producing various diseases, according to the character of the impurity and the quantity present.

Among the diseases due to impure water are the following: Diarrhœa, Dyspepsia, Constipation, Dysentery, Malarial Fevers, Typhoid, Cholera, Yellow Fever, Skin Diseases, Diseases of the Bones and Urinary Organs, etc.

CHAPTER VI.

WATER-SUPPLY.

Water-supply.—Wherever there is a large number of people in one place, the quantity of water needed for the use of the population is very great, and a supply of sufficient quantity and quality becomes a sanitary problem of great importance. The importance of this problem had been recognized very early in the history of man; and we find in many ancient lands quite successful attempts to supply water on a grand scale. In Egypt artificial lakes were made to provide an adequate water-supply in places where the natural supply by the Nile was insufficient. Remains of gigantic water-basins of marvellous construction have been found in Peru and Mexico. In Ceylon there is found the remains of a great tank or artificial lake, 40 miles in circumference. It was in ancient Rome, however, that municipal water-supply reached its zenith of development. In the year 614 B.C. King Ancus Marcius began the first great aqueduct which supplied Rome with pure water drawn from a distant mountain; and at the end of the first century A.D. we find in Rome 14 aqueducts supplying 375 millions of gallons, or about 300 gallons per head per diem.

During the middle ages all sanitary measures, and also municipal water-supply, were neglected; and coming down to more recent times, we find that in the United States, at the beginning of the 19th century, only 17 water-works were in existence. During the past century, however, great progress has been made in this as well as in other sanitary matters; and at present we find in the United States nearly 4,000 water-supplying works, most of them being owned by municipalities.

Sources of Water-supply.—The sources of water are, as we have seen in the last chapter: 1) Rain, 2) surface-water, and 3) subsurface-water.

Rain-water.—The supply of rain-water is uncertain, variable in quantity, and unreliable in quality.

The quality of rain-water, apart from its lack of aeration, is good, but only a small part of the water needed can be conveniently collected for immediate use; and in order to make provision for future use, various receptacles must be employed for the storage of rain-water and its distribution. The receptacles employed for storage, etc., of rain-water are liable to be contaminated, causing the impurities to pollute the water. As a rule, little reliance can be placed upon supplying a large number of people from rain-water directly.

Surface-water.—Surface-water is but rain collected on the surface in the form of ponds, lakes, and rivers, which serve as natural reservoirs and storage-tanks for the collection of fresh water. The water from these sources is easy to obtain, and in unpopulated districts is, as a rule, very pure and fit for drinking purposes. The character of these waters depends, however, upon the

nature of the soil in which they are located, and the degree of contamination due to sewage, refuse, and organic impurities drained into the watercourses. The proximity of dwellings, towns, factories, etc., is of great importance, and greatly influences the character and purity of the natural water-supply.

Subsurface-waters.—The water gained from underground sources is that found in springs and wells.

Springs are natural outcroppings of subsoil-water, and are numerous in some mountain regions. The character of spring-water varies according to the source, temperature, and physical character of the soils through which the water passes. There are iron, sulphur, salt, and other springs, according to the minerals they contain; there are also springs the waters of which are of high temperature. But in the great majority of springs the water is cool, free from impurities, and wholesome.

Wells are holes bored in the ground to certain levels at which water is found. They are of two kinds: shallow and deep. The shallow wells are those in which the water percolated into the ground and collected immediately under the first permeable soil-stratum, usually 20 to 50 feet from the surface. The quality of shallow-well water is suspicious on account of the frequent contamination of the soil by the drainage from nearby as well as far-distant cesspools and sewers, whereby a great quantity of organic impurities may drain into it. When free from contamination the water from shallow wells is wholesome.

Deep wells, or artesian wells, as they are also called, are wells the depth of which is over 50 feet from the

surface; and as the water in these wells is from the deep underlying soil-strata, it is consequently free from surface contamination, and is very good for drinking purposes.

Storage, Collection, and Distribution.—Whenever a large quantity of water is required for future use, the water must be collected and stored in appropriate receptacles made for the purpose. The collection, storage, and distribution of water is an engineering problem which cannot be gone into here. Storage-tanks and reservoirs are constructed of brick, stone, or cement, if large, and of iron or wood, if small. All storage-vessels are liable to be contaminated, hence means must be provided to protect and cleanse them.

Where the source of water-supply is distant from the place of delivery, means have to be provided for conveying the water into the towns, etc., where it is to be used; this is done by stone and brick, also iron and lead conduits and pipes, through which the water passes. There are some objections to iron as well as to lead pipes. Iron becomes rusty in time, and lead is prone to impart to the water some of its metal, and thus may cause lead-poisoning. Glazed iron pipes and pipes coated with various non-absorbing substances have been devised to meet these objections.

Purification.—To free water from its impurities, the following various processes are in use.

1) *Distillation.* This is the best and only way to get absolutely pure water free from any contamination. Distilled water has a somewhat insipid taste, but this is overcome after thorough aeration of the water.

2) *Boiling.* This is the second best method, as the subjection of water to a continuous temperature of 212° F. kills most of the bacteria, and renders harmless all other impurities except mineral poisons.

3) *Chemical treatment.* The addition of certain chemicals, such as alum, boric acid, potassium permanganate, etc. These purify the water, but their use is not a desirable method.

4) *Filtration.* Water, when passing through gravel, sand, powdered pumice-stone, charcoal, etc., loses part or most of the suspended impurities contained in it. The method of purification of water by filtration is most in vogue, not only in domestic, but also in municipal, economy. To be effective, filtration must be thorough, and a more or less frequent change of filter is necessary. The average domestic filter, however, is a snare and a delusion, and gives but little protection.

CHAPTER VII.

DISPOSAL OF SEWAGE.

Waste Products.—There is a large amount of waste products in human and social economy. The products of combustion, such as ashes, cinders, etc.; the products of street sweepings and waste from houses, as dust, rubbish, paper, etc.; the waste from various trades; the waste from kitchens, *e.g.*, scraps of food, etc.; the waste water from the cleansing processes of individuals, domestic animals, clothing, etc.; and finally the excreta—urine and feces—of man and animals; all these are waste products that cannot be left undisposed of, more especially in cities and wherever a large number of people congregate. All waste products are classified into three distinct groups: 1) Refuse, 2) Garbage, and 3) Sewage.

The amount of *refuse* and *garbage* in cities is quite considerable; in Manhattan alone the dry refuse amounts to 1,000,000 tons a year, and that of garbage to 175,000 tons per year. A large percentage of the dry refuse and garbage is valuable from a commercial standpoint, and could be utilized with proper facilities for collection and separation. The disposal of refuse and garbage has not as yet been satisfactorily dealt with. The modes of waste disposal in the United States

are: 1) Dumping into the sea; 2) filling in made land, or ploughing into lands; 3) cremation; and 4) reduction by various processes and the products utilized.

Sewage.—By sewage we mean the waste and effete human matter and excreta—the urine and feces of human beings and the urine of domestic animals (the feces of horses, etc., has great commercial value, and is usually collected separately and disposed of for fertilizing purposes).

The amount of excreta per person has been estimated (Frankland) as 3 ounces of solid and 40 ounces of fluid per day, or about 30 tons of solid and 100,000 gallons of fluid for each 1000 persons per year.

In sparsely populated districts the removal and ultimate disposal of sewage presents no difficulties; it is returned to the soil, which, as we know, is capable of purifying, disintegrating, and assimilating quite a large amount of organic matter. But when the number of inhabitants to the square mile increases, and the population becomes as dense as it is in some towns and cities, the disposal of the human waste products becomes a question of vast importance, and the proper, as well as the immediate and final, disposal of sewage becomes a serious sanitary problem.

It is evident that sewage must be removed in a thorough manner, otherwise it would endanger the lives and health of the people.

The dangers of sewage to health are:

1) From its offensive odors, which, while not always directly dangerous to health, often produce headaches, nausea, etc.

2) The organic matter contained in sewage decomposes and eliminates gases and other products of decomposition.

3) Sewage may contain a large number of pathogenic bacteria (typhoid, dysentery, cholera, etc.).

4) Contamination of the soil, ground-water, and air, by percolation of sewage.

The problem of sewage-disposal is twofold: 1) Immediate; viz., the need of not allowing sewage to remain too long on the premises, and its immediate removal beyond the limits of the city; and 2) the final disposition of the sewage, after its removal from the cities, etc.

Modes of Ultimate Disposal of Sewage.—The chief constituents of sewage are organic matter, mineral salts, nitrogenous substances, potash, and phosphoric acid. Fresh-mixed excrementitious matter has an acid reaction, but within 12–20 hours it becomes alkaline, because of the free ammonia formed in it. Sewage rapidly decomposes, evolving organic and fetid matters, ammonium sulphide, sulphuretted and carburetted hydrogen, etc., besides teeming with animal and bacterial life. A great many of the substances contained in sewage are valuable as fertilizers of soil.

The systems of final disposal of sewage are as follows:

1) Discharge into seas, lakes, and rivers.

2) Cremation.

3) Physical and chemical precipitation.

4) Soil filtration.

5) Land irrigation.

Discharge into Waters.—The easiest way to dispose

of sewage is to let it flow into the sea or other running watercourse. The objections to sewage discharging into the rivers and lakes near cities, and especially such lakes and rivers as supply water to the municipalities, are obvious. But as water can purify a great amount of sewage, this method is still in vogue in certain places, although it is to be hoped that it will in the near futue be superseded by more proper methods. The objection against discharging into seas is the operation of the tides, which cause a backflow and overflow of sewage from the pipes. This backflow is remedied by the following methods: 1) Providing tidal flap-valves, permitting the outflow of sewage, but preventing the inflow of sea-water; 2) discharging the sewage intermittently, only during low tide; and 3) providing a constant outflow by means of steam-power pressure.

Cremation.—Another method of getting rid of the sewage without attempting to utilize it is by cremation. The liquid portion of the sewage is allowed to drain and discharge into watercourses, and the more or less solid residues are collected and cremated in suitable crematories.

Precipitation.—This method consists in separating the solid matters from the sewage by precipitation by physical or chemical processes, the liquid being allowed to drain into rivers and other waters, and the precipitated solids utilized for certain purposes. The precipitation is done either by straining the sewage, collecting it into tanks, and letting it subside, when the liquid is drawn off and the solids remain at the bottom of the tanks, a rather unsatisfactory method; or, by chemical

processes, precipitating the sewage by chemical means, and utilizing the products of such precipitation. The chemical agents by which precipitation is accomplished are many and various; among them are lime, alum, iron perchloride, phosphates, etc.

Soil Filtration.—The sewage is filtered by passing it through some porous soil, by which it is purified and oxidized; if the filtration is intermittent and the soil porous and well drained, a large amount of sewage can be disposed of by this process.

Land Irrigation.—In this method the organic and other useful portions of sewage are utilized for irrigating land, to improve garden and other vegetable growths by feeding the plants with the organic products of animal excretion. Flat land, with a gentle slope, is best suited for irrigation. The quantity of sewage disposed of will depend on the character of the soil, its porosity, the time of the year, temperature, intermittency of irrigation, etc. As a rule, one acre of land is sufficient to dispose of the sewage of 100 to 150 people.

Sewage-disposal in the United States.—According to its location, position, etc., each city in the United States has its own method of final disposition of sewage. Either one or the other, or a combination of two of the above methods, are used.

The following cities discharge their sewage into the sea: Portland, Salem, Lynn, Gloucester, Boston, Providence, New York, Baltimore, Charleston, and Savannah.

The following cities discharge their sewage into rivers

and lakes: Philadelphia, Cincinnati, St. Louis, Albany, Minneapolis, St. Paul, Washington, Buffalo, Detroit, Richmond, Chicago, Milwaukee, and Cleveland.

"Worcester uses chemical precipitation. In Atlanta a part of the soil is cremated, but the rest is deposited in pits 8 × 10 feet, and 5 feet deep. It is then thoroughly mixed with dry ashes from the crematory, and afterwards covered with either grain or grass. In Salt Lake City and in Woonsocket it is disposed of in the same way. In Indianapolis it is composted with marl and sawdust, and after some months used as a fertilizer. A portion of the sewage is cremated in Atlanta, Camden, Dayton, Evansville, Findlay, O., Jacksonville, McKeesport, Pa., Muncie, and New Brighton. In Atlanta, in 1898, there were cremated 2362 loads of sewage. In Dayton, during 30 days, there were cremated 1900 barrels of 300 pounds each." *(Chapin, Mun. San. in U. S.)*

The Immediate Disposal of Sewage.—The final disposition of sewage is only one part of the problem of sewage-disposal; the other part is how to remove it from the house into the street, and from the street into the places from which it is finally disposed.

The immediate disposal of sewage is accomplished by two methods—the so-called *dry*, and the *water-carriage*, methods. By the *dry method* we mean the removal of sewage without the aid of water, simply collecting the dry and liquid portions of excreta, storing it for some time, and then removing it for final disposal. By the *water-carriage method* is understood the system by which sewage, solid and liquid, is flushed

out by means of water, through pipes or conduits called sewers, from the houses through the streets to the final destination.

The Dry Methods.—The dry or conservacy method of sewage-disposal is a primitive method used by all ancient peoples; in China at the present time, and in all villages and sparsely populated districts; it has for its basic principle the return to mother earth of all excreta, to be used and worked over in its natural laboratory. The excreta are simply left in the ground to undergo in the soil the various organic changes, the difference in methods being only as regards the vessels of collection and storage.

The methods are:

1) Cesspool and privy-vault.

2) Pail system.

3) Physico-chemical system—earth, ashes, etc.

4) Pneumatic system.

The Privy-vault is the general mode of sewage-disposal in villages, some towns, and even in some large cities, wherever sewers are not provided. In its primitive and unfortunately common form, the privy-vault is nothing but a hole dug in the ground near or at some distance from the house; the hole is but a few feet deep, with a plank or rough seat over it, and an improvised shed over all. The privy is filled with the excreta; the liquids drain into the adjacent ground, which becomes saturated, and contaminates the nearest wells and watercourses. The solid portion is left to accumulate until the hole is filled or the stench becomes unbearable, when the hole is either covered up and forgotten, or

the excreta are removed and the hole used over again. This is the common privy as we so often find it near the cottages and mansions of our rural populace, and even in towns. A better and improved form of privy is that built in the ground, and made water-tight by being constructed of bricks set in cement, the privy being placed at a distance from the house, the shed over it ventilated, and the contents of the privy removed regularly and at stated intervals before they become a nuisance. At its best, however, the privy-vault is an abomination, as it can scarcely be so well constructed as not to contaminate the surrounding soil, or so often cleaned as to prevent decomposition and the escape of poisonous gases.

The Pail System is an economic, simple, and, on the whole, very efficient method of removing fresh excreta. The excreta are passed directly into stone or metal water- and gas-tight pails, which, after filling, are hermetically covered and removed to the places for final disposal. This system is in use in Roachdale, Manchester, Glasgow, and other places in England.

The Physico-chemical System consists in mixing various ingredients, such as dry earth, ashes, charcoal, carbolic acid, carbolated sand, etc., so as to disinfect and deodorize the excreta, which are then either used as a fertilizer, or are disposed of in other ways.

The Pneumatic System is a rather complicated mechanical method invented by a Dutch engineer, and is used extensively in Holland. In this system the excreta are passed to certain pipes and receptacles, and from there aspirated by means of air exhausts.

The Water-carriage System.—We now come to the modern mode of using water to carry and flush all sewage material. This method is being adopted throughout the civilized world. For it is claimed the reduction of the mortality rate wherever it is introduced. The water-carriage system presupposes the construction and existence of pipes from the house to and through the street to the place of final disposition. The pipes running from the house to the streets are called house-sewers; and when in the streets, are called street-sewers.

The Separate and Combined Systems.—Whenever the water-carriage system is used, it is either intended to carry only sewage proper, viz., solid and liquid excreta flushed by water, or rain-water and other waste water from the household, in addition. The water-carriage system is accordingly divided into two systems: *the combined,* by which all sewage and all waste and rain-water are carried through the sewers, and the *separate* system, in which two groups of pipes are used: the sewers proper to carry sewage only, and the other pipes to dispose of rain-water and other uncontaminated waste water. Each system has its advocates, its advantages, and disadvantages.

The advantages claimed for the separate system are as follows:

1) Sewers may be of small diameter, not more than 6 inches.

2) Constant, efficient flow and flushing of sewage.

3) The sewage gained is richer in fertilizing matter.

4) The sewers never overflow, as is frequently the case in the combined system.

5) The sewers being small, no decomposition takes place therein.

6) Sewers of small diameter need no special means of ventilation, or main traps on house-drains, and can be ventilated through the house-pipes.

On the other hand, the disadvantages of the separate system are:

1) The need of two systems of sewers, for sewage and for rain-water, and the expense attached thereto.

2) The sewers used for sewage proper require some system for periodically flushing them, which, in the combined system, is done by the occasional rains.

3) Small sewers cannot be as well cleaned or gotten at as larger ones.

The separate system has been used in Memphis and in Keene, N. H., for a number of years with complete satisfaction. Most cities, however, use the combined system.

CHAPTER VIII.

SEWERS.

Definitions.—A sewer is a conduit or pipe intended for the passage of sewage, waste, and rain-water.

A *house-sewer* is the branch sewer extending from a point two feet outside of the outer wall of the building to its connection with the street-sewer, etc.

Materials.—The materials from which sewers are constructed are iron, cement, and vitrified pipe.

Iron is used only for pipes of small diameter; and as most of the sewers are of greater diameter than 6 inches, they are made of other material than iron.

Cement and brick sewers are frequently used, and, when properly constructed, are efficient, although the inner surface of such pipes is rough, which causes adherence of sewage matter.

The most common material of which sewers are manufactured is earthenware, "vitrified pipes."

"Vitrified pipes are manufactured from some kind of clay, and are salt-glazed inside. Good vitrified pipe must be circular and true in section, of a uniform thickness, perfectly straight, and free from cracks or other defects; they must be hard, tough, not porous, and have

a highly smooth surface. The thicknesses of vitrified pipes are as follows:

4	inches diameter	....	$\frac{1}{2}$	inch thick
6	" "	....	$\frac{11}{16}$	" "
8	" "	....	$\frac{3}{4}$	" "
12	" "	....	1	" "

The pipes are made in 2- and 3-foot lengths, with spigot- and socket-ends." (Gerhardt.)

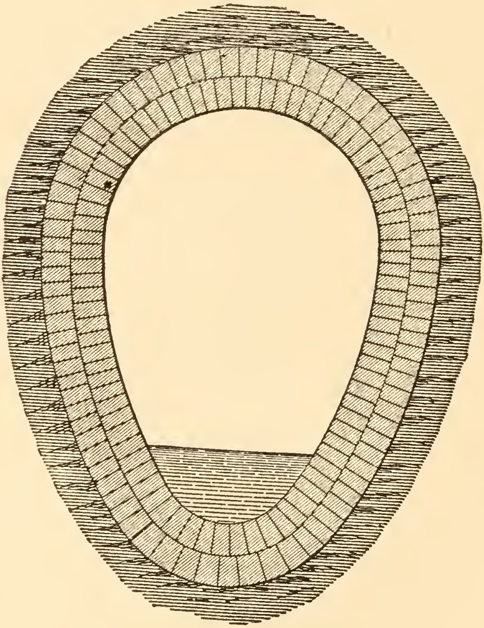


Fig. 13.—Brick Sewer.

Sewer-pipes are laid in trenches at least 3 feet deep, to insure against the action of frosts.

Construction.—The level of the trenches in which sewers are laid should be accurate, and a hard bed must be secured or prepared for the pipes to lie on. If the ground is sandy and soft, a solid bed of concrete should be laid, and the places where the joints are should be hollowed out, and the latter embedded in cement.

Joints.—The joints of the various lengths must be gas-tight, and are made as follows: Into the hub (the enlargement on one end of the pipe) the spigot-end of the next length is inserted, and in the space left between the two a small piece, or gasket, of oakum, is rammed in; the remaining space is filled in with a mixture of the best Portland cement and clean, sharp sand. The office of the oakum is to prevent the cement from getting on the inside of the pipe. The joint is then wiped around with additional cement.

Fall.—In order that there should be a steady and certain flow of the contents of the sewer, the size and fall of the latter must be suitable; that is, the pipes must be laid with a steady, gradual inclination or fall toward the exit. This fall must be even, without sudden changes, and not too great or too small.

The following has been determined to be about the right fall for the sizes stated:

4-inch	pipe....	1 foot	in	40	feet
6 "	"	1 "	"	60	"
9 "	"	1 "	"	90	"
12 "	"	1 "	"	120	"

Flow.—The velocity of the flow in sewers depends on the volume of their contents, the size of the pipes, and

the fall. The velocity should not be less than 120 feet in a minute, or the sewer will not be self-cleansing.

Size.—In order for the sewer to be self-cleansing, its size must be proportional to the work to be accomplished, so that it may be fully and thoroughly flushed and not permit stagnation and consequent decomposition of its contents. If the sewer be too small, it will not be adequate for its purpose, and will overflow, back up, etc.; if too large, the velocity of the flow will be too low, and stagnation will result. In the separate system, where there is a separate provision for rain-water, the size of the sewer ought not to exceed 6 inches in diameter. In the combined system, however, when arrangements must be made for the disposal of large volumes of storm-water, the size of the sewer must be larger, thus making it less self-cleansing.

Connections.—The connections of the branch sewers and the house-sewers with the main sewer must be carefully made, so that there shall be no impediment to the flow of the contents, either of the branches or of the main pipe. The connections must be made gas-tight; not at right angles or by T branches, but by bends, curves, and Y branches, in the direction of the current of the main pipe, and not opposite other branch pipes; and the junction of the branch pipes and the main pipe must not be made at the crown or at the bottom of the sewer, but just within the water-line.

Tide-valves.—Where sewers discharge their contents into the sea, the tide may exert pressure upon the contents of the sewer and cause "backing up," blocking up the sewer, bursting open trap-covers, and overflow-

ing into streets and houses. To prevent this, there are constructed at the mouth of the street-sewers, at the outlets to the sea, proper valves or tide-flaps, so constructed as to permit the contents of the sewers to flow out, yet prevent sea-water from backing up by immediately closing upon the slightest pressure from outside.

House-sewers.—Where the ground is "made," or filled in, the house-sewer must be made of cast iron, with the joints properly calked with lead. Where the soil consists of a natural bed of loam, sand, or rock, the house-sewer may be of hard, salt-glazed, and cylindrical earthenware pipe, laid in a smooth bottom free from projections of rock, and with the soil well rammed to prevent any settling of the pipe. Each section must be wetted before applying the cement, and the space between each hub and the small end of the next section must be completely and uniformly filled with the best hydraulic cement. Care must be taken to prevent any cement being forced into the pipe to form an obstruction. No tempered-up cement should be used. A straight-edge must be used inside the pipe, and the different sections must be laid in perfect line on the bottom and sides.

Connections of the house-sewer [when of iron] with the house main pipe must be made by lead-calked joints; the connection of the iron house-pipe with the earthenware house-sewer must be made with cement, and should be gas-tight.

Sewer-air and Gas.—Sewer-gas is not a gas at all. What is commonly understood by the term is the air of sewers, the ordinary atmospheric air, but charged

and contaminated with the various products of organic decomposition takes place in sewers. Sewer-air is a mixture of gases, the principal gases being carbonic acid; marsh gas; compounds of hydrogen and carbon; carbonate and sulphides of ammonium; ammonia; sulphuretted hydrogen; carbonic oxide, volatile fetid matter; organic putrefactive matter, and pathogenic and other bacteria.

It is evident that an air charged with so many impurities is not fit to be respired, and, when inhaled, will produce effects injurious to health. It has been proved that not only does sewer-air produce a lowering of the vital forces and a general decline of health in those habitually breathing it, but that it is also capable of directly causing many and various diseases. The contents of sewers are the breeding-places for various virulent bacteria of infectious diseases, such as typhoid, dysentery, diarrhœa, etc., and constitute a favorable culture-medium for all other disease-causing organisms. Sewer-air is, therefore, directly dangerous to health and life.

Ventilation.—To guard against the bad effects of sewer-air, it is necessary to dilute, change, and ventilate the air in sewers. This is accomplished by the various openings left in the sewers, the so-called lamp and manholes which ventilate by diluting the sewer-air with the street-air. In some places, chemical methods of disinfecting the contents of sewers have been undertaken with a view to killing the disease-germs and deodorizing the sewage. In the separate system of sewage-disposal, where sewer-pipes are small and usually

self-cleansing, the late Col. Waring proposed to ventilate the sewers through the house-pipes, omitting the usual disconnection of the house-sewer from the house-pipes. But in the combined system such a procedure would be dangerous, as the sewer-air would be apt to enter the house.

Rain-storms are the usual means by which a thorough flushing of the street-sewers is effected. There are, however, many devices proposed for flushing sewers; *e.g.*, by special flushing-tanks, which either automatically or otherwise discharge a large volume of water, thereby flushing the contents of the street-sewers.

CHAPTER IX.

PLUMBING. GENERAL PRINCIPLES.

Purpose and Requisites of House-plumbing.—A system of house-plumbing presupposes the existence of a street-sewer, and a water-supply distribution within the house. While the former is not absolutely essential, as a house may have a system of plumbing without there being a sewer in the street, still in the water-carriage system of disposal of sewage the street-sewer is the outlet for the various waste and excrementitious matter of the house. The house-water distribution serves for the purpose of flushing and cleaning the various pipes in the house-plumbing.

The purposes of house-plumbing are: 1) to get rid of all excreta and waste water; 2) to prevent any foreign matter and gases in the sewer from entering the house through the pipes; and 3) to dilute the air in the pipes so as to make all deleterious gases therein innocuous.

To accomplish these results, house-plumbing demands the following requisites:

1) *Receptacles* for collecting the waste and excreta. These receptacles, or plumbing fixtures, must be adequate for the purpose, small, non-corrosive, self-cleans-

ing, well flushed, accessible, and so constructed as to easily dispose of their contents.

2) *Separate vertical pipes* for sewage proper, for waste water, and for rain-water; upright, direct, straight, non-corrosive, water- and gas-tight, well flushed, and ventilated.

3) Short, direct, clean, well flushed, gas-tight branch pipes to connect receptacles with vertical pipes.

4) *Disconnection* of the house-sewer from the house-pipes by the main trap on house-drain, and disconnection of house from the house-pipes by traps on all fixtures.

5) *Ventilation* of the whole system by the fresh-air inlet, vent-pipes, and the extension of all vertical pipes.

Definitions.—The *house-drain* is the horizontal main pipe receiving all waste water and sewage from the vertical pipes, and conducting them outside of the foundation-walls, where it joins the house-sewer.

The *soil-pipe* is the vertical pipe or pipes receiving sewage matter from the water-closets in the house.

The *main waste-pipe* is the pipe receiving waste water from any fixtures except the water-closets.

Branch soil- and waste-pipes are the short pipes between the fixtures in the house and the main soil- and waste-pipes.

Traps are bends in pipes, so constructed as to hold a certain volume of water, called the water-seal; this water-seal serves as a barrier to prevent air and gases from the sewer from entering the house.

Vent-pipes are the special pipes to which the traps or fixtures are connected by short-branch vent-pipes, and

serve to ventilate the air in the pipes, and prevent syphonage.

The *rain-leader* is the pipe receiving rain and storm-water from the roof of the house.

Materials Used for Plumbing Pipes.—The materials from which the different pipes used in house-plumbing are made differ according to the use of each pipe, its position, size, etc. The following materials are used: cement, vitrified pipe, lead, cast, wrought, and galvanized iron, brass, steel, nickel, sheet metal, etc.

Cement and vitrified pipes are used for the manufacture of street- and house-sewers. In some places vitrified pipe is used for house-drains, but in most cities this is strongly objected to; and in New York City no earthenware pipes are permitted within the house. The objection to earthenware pipes are that they are not strong enough for the purpose, break easily, and cannot be made gas-tight.

Lead pipe is used for all branch waste-pipes, and short lengths of water-pipes. The advantage of lead pipes is that they can be easily bent and shaped, hence their use for traps and connections. The disadvantage of lead for pipes is the softness of the material, which is easily broken into by nails, gnawed through by rats, etc.

Brass, nickel, steel, and other such materials are used in the manufacture of expensive plumbing, but are not commonly employed.

Sheet metal and *galvanized iron* are used for rain-leaders, refrigerator-pipes, etc.

Wrought iron is used in the so-called Durham system

of plumbing. Wrought iron is very strong; the sections of pipe are 20 feet long, the connections are made by screw-joints, and a system of house-plumbing made of this material is very durable, unyielding, strong, and perfectly gas-tight. The objections to wrought iron for plumbing-pipes are that the pipes cannot be readily repaired and that it is too expensive.

Cast iron is the material universally used for all vertical and horizontal pipes in the house. There are two kinds of cast-iron pipes manufactured for plumbing uses: the "standard and the extra heavy."

The following are the relative weights of each:

Standard.		Extra Heavy.
2-inch pipe,	4 lbs. per foot	5½ lbs.
3 " "	6 " " "	9½ "
4 " "	9 " " "	13 "
5 " "	12 " " "	17 "
6 " "	15 " " "	20 "
7 " "	20 " " "	27 "
8 " "	25 " " "	33½ "

The light-weight pipe, though extensively used by plumbers, is generally prohibited by most municipalities, as it is not strong enough for the purpose, and it is difficult to make a gas-tight joint with these pipes without breaking them.

Cast-iron pipes are made in lengths of 5 feet each, with an enlargement on one end of the pipe, called the "hub" or "socket," into which the other, or "spigot" end, is fitted. All cast-iron pipe must be straight,

sound, cylindrical and smooth, free from sand-holes, cracks, and other defects, and of a uniform thickness.

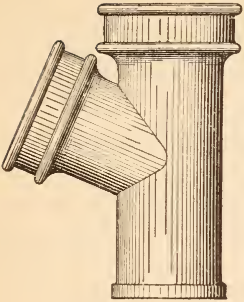
The thickness of cast-iron pipes should be as follows:

2-inch	pipe	$\frac{5}{16}$	inches	thick.	
3	"	"	"	"	"
4	"	"	$\frac{3}{8}$	"	"
5	"	"	$\frac{7}{16}$	"	"
6	"	"	$\frac{1}{2}$	"	"

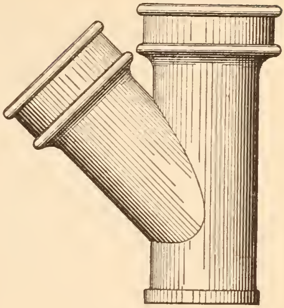
Cast-iron pipes are sometimes coated by dipping into hot tar, or by some other process. Tar-coating is, however, not allowed in New York, because it conceals the sand-holes and other flaws in the pipes.

Joints and Connections.—To facilitate connections of cast-iron pipes, short and convenient forms and fittings are cast, as seen in Figs. 14 and 15. Some of these connections are named according to their shape, such as L, T, Y, etc.

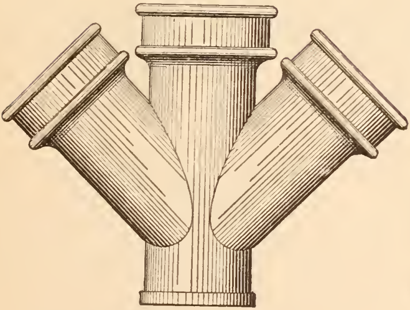
Iron pipe is joined to *iron pipe* by lead-calked joints. These joints are made as follows: the spigot end of one pipe is inserted into the enlarged end, or the "hub," of the next pipe. The space between the spigot and hub is half filled with oakum or dry hemp. The remaining space is filled with hot molten lead, which, on cooling, is well rammed and calked in by special tools made for the purpose. To make a good, gas-tight, lead-calked joint, experience and skill are necessary. The ring of lead joining the two lengths of pipe must be from 1 to 2 inches deep, and from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch thick; 12 ounces of lead must be used at each joint for each inch



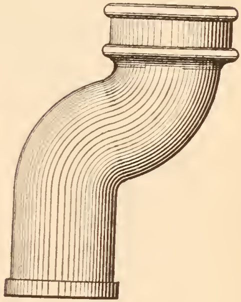
SHORT Y BRANCH.



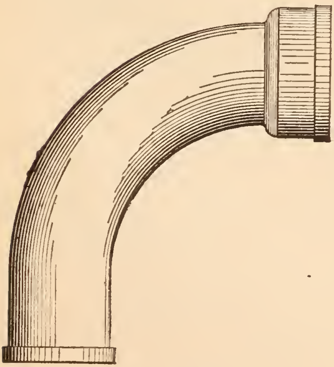
LONG Y BRANCH.



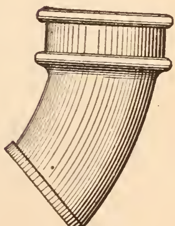
DOUBLE Y BRANCH.



OFFSET.

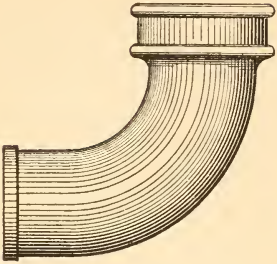


90° BEND.

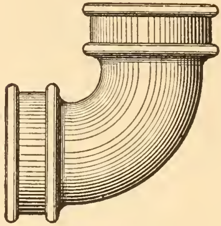


$\frac{1}{8}$ BEND.

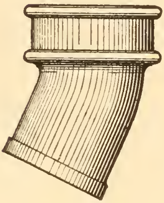
FIGS. 14–15.



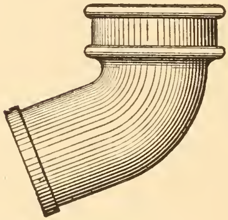
$\frac{1}{4}$ Bend.



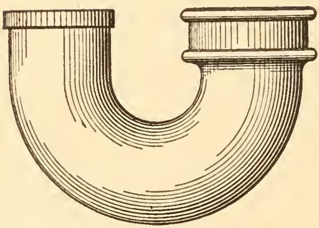
$\frac{1}{4}$ Bend.



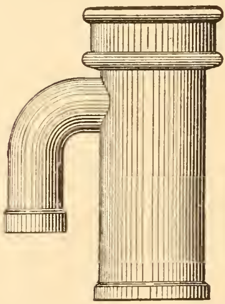
$\frac{1}{16}$ Bend.



$\frac{1}{6}$ Bend.

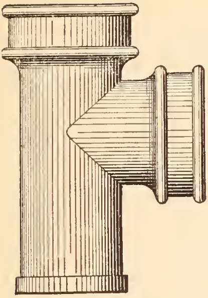


Return-bend.

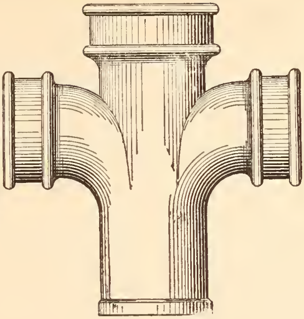


Vent-branch for Back Air-pipe.

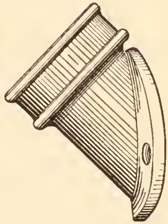
Figs. 14–15.



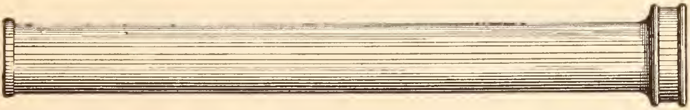
T BRANCH.



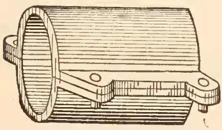
DOUBLE T-Y.



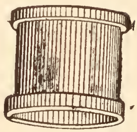
Y-SADDLE HUB.



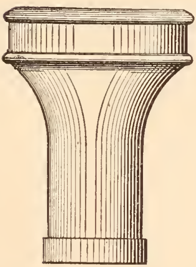
LENGTH OF SOIL-PIPE WITH SINGLE HUB.



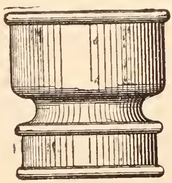
PIPE BEND.



BRASS FERRULE.



INCREASER.



REDUCER.

FIGS. 14–15.

in the diameter of the pipe. Iron pipes are sometimes connected by means of so-called rust-joints. Instead of lead, the space between the socket and spigot is filled in with an iron cement consisting of 98 parts of cast-iron borings, 1 part of flowers of sulphur, and 1 part of sal ammoniac.

All connections between *lead pipes* and between *lead* and *brass* or *copper* pipes must be made by means of "wiped" solder-joints. A wiped joint is made by solder being poured on two ends of the two pipes, the solder being worked about the joint, shaped into an oval lump, and wiped around with a cloth, giving the joint a bulbous form.

All connections between *lead pipes* and *iron pipes* are made by means of brass ferrules. Lead cannot be soldered to iron, so a brass fitting or ferrule is used; it is jointed to the lead pipe by a wiped joint, and to the iron pipe by an ordinary lead-calked joint.

Putty, *cement*, and *slip* joints should not be tolerated on any pipes.

Traps.—We have seen that a trap is a bend in a pipe so constructed as to hold a quantity of water sufficient to interpose a barrier between the sewer and the fixture. There are many and various kinds of traps, some depending on water alone as their "seal," others employing mechanical means, such as balls, valves, lips, also mercury, etc., to assist in the disconnection between the house and sewer ends of the pipe system.

The value of a trap depends: 1) on the depth of its water-seal; 2) on the strengths and permanency of the seal; 3) on the diameter and uniformity of the trap;

4) on its simplicity; 5) on its accessibility; and 6) on its self-cleansing character.

The depth of a trap should be about 3 inches for water-closet traps, and about 2 inches for sink and other traps.

Traps must not be larger in diameter than the pipe to which they are attached.

The simpler the trap, the better it is.

Traps should be provided with cleanout screw-openings, caps, etc., to facilitate cleaning.

The shapes of traps vary, and the number of the various kinds of traps manufactured is very great.

Traps are named according to their use: gully, grease, sediment, intercepting, etc.; according to their shape: D, P, S, V, bell, bottle, pot, globe, etc,; and according to the name of their inventor: Buchan, Cottam, Dodd, Antill, Renk, Hellyer, Croydon, and others too numerous to mention. Figs. 16 and 17 show some forms of traps.

The S trap is the best for sink waste-pipes; the running trap is the best on house-drains.

Loss of Seal by Traps.—The seals of traps are not always secure, and the causes of unsealing of traps are as follows:

1) *Evaporation.* If a fixture in a house is not used for a long time, the water constituting the seal in the trap of the fixture will evaporate; the seal will thus be lost, and ingress of sewer-air will result. To guard against evaporation, fixtures must be frequently flushed; and during summer, or at such times as the house is unoccupied and the fixtures not used, the traps

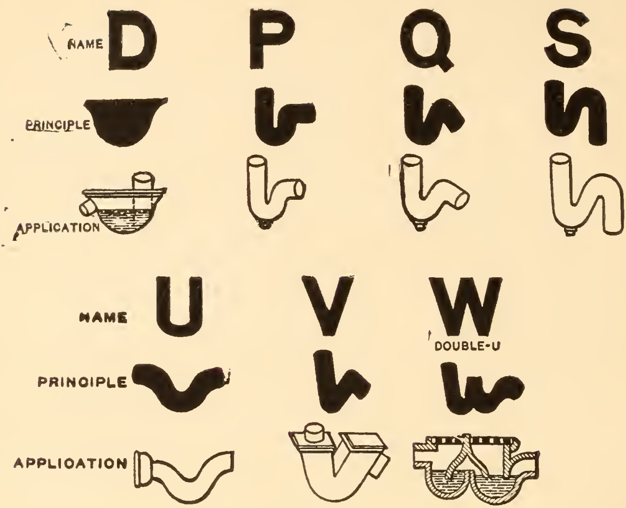


FIG. 16.—NOMENCLATURE. (KNIGHT).

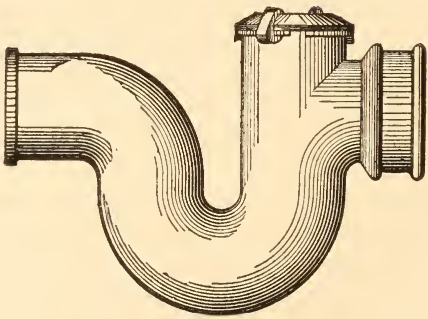
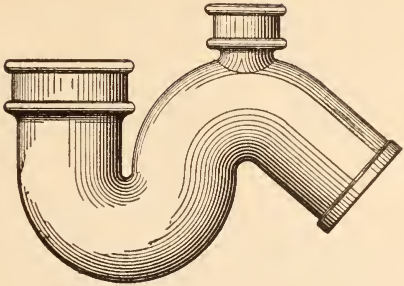
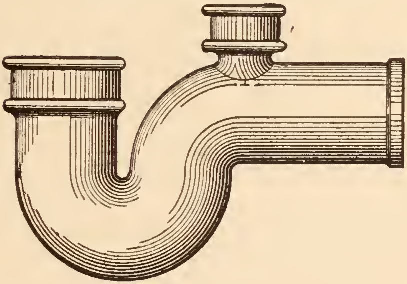


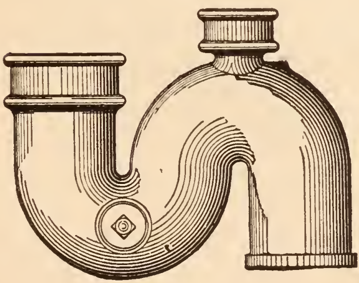
FIG. 17.—RUNNING TRAP.



$\frac{3}{4}$ S Trap.



$\frac{1}{2}$ S Trap.



S Trap.

Fig. 17.

are to be filled with oil or glycerine, either of which will serve as an efficient seal.

2) *Momentum.* A sudden flow of water from the fixture may, by the force of its momentum, empty all water in the trap and thus leave it unsealed. To prevent the unsealing of traps by momentum, they must be of a proper size, not less than the waste-pipe of the fixture, the seal must be deep, and the trap in a perfectly straight position, as a slight inclination will favor its emptying. Care should also be taken while emptying the fixture to do it slowly so as to preserve the seal.

3) *Capillary attraction.* If a piece of paper, cotton, thread, hair, etc., remain in the trap, and a part of the paper, etc., projecting into the lumen of the pipe, a part of the water will be withdrawn by capillary attraction from the trap and may unseal it. To guard against unsealing of traps by capillary attraction, traps should be of a uniform diameter, without nooks and corners and of not too large a size, and should also be well flushed, so that nothing but water remain in the trap.

Syphonage. A large volume of water completely filling and descending a vertical pipe must in its course create powerful suction, and may, by the force of its suction and the vacuum created, aspirate all contents of smaller waste-pipes and the traps connected with the same vertical pipe; the water-seal is thus taken out of the traps, leaving them unsealed. This action is called syphonage.

One way to prevent the syphonage of traps is by the employment of mechanical means to assist the water-

seal. This is done in the mechanical traps, which, while of value at times, are rather cumbersome and liable to get out of order.

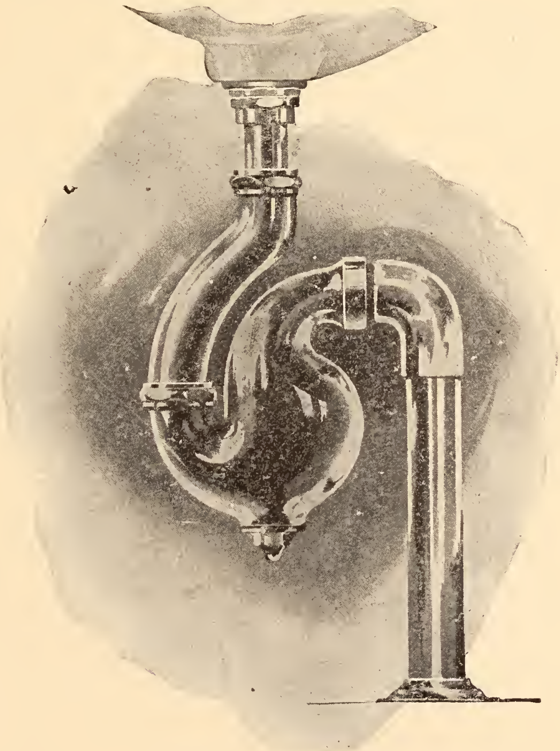


FIG. 17.—NON-SYPHONING TRAP.

The other way to prevent the unsealing of traps is to avoid the creating of a vacuum by extending the vertical pipes over the roof and by connecting the traps with open vent-pipes, the air in which will prevent the

formation of a vacuum and consequent syphonage of the traps. This is provided in the vent system. Each trap at its upper portion, or crown, is connected with a branch pipe running up to and joining a straight pipe which leads out to the air, thus giving each trap a certain column of air to prevent the creation of a vacuum. This vent system also serves the purpose of ventilating the air in the traps and the pipes connecting with them.

CHAPTER X.

PLUMBING-PIPES.

The House-drain.—All waste and soil matter in the house is carried from the receptacles into the waste- and soil-pipes, and from these into the house-drain, the main pipe of the house, which carries all waste and soil into the street-sewer. The house-drain extends from the junction of the soil- and waste-pipes of the house through the house to outside of the foundations 2–5 feet, whence it is called "house-sewer." The house-drain is a very important part of the house-plumbing system, and great care must be taken to make its construction perfect.

Material. The material of which house-drains are manufactured is extra heavy cast iron. Lighter pipes should never be used, and the use of vitrified pipes for this purpose should not be allowed.

Size. The size of the house-drain must be proportional to the work to be performed. Too large a pipe will not be self-cleansing, and the bottom of it will fill with sediment and slime. Were it not for the need of carrying off large volumes of storm-water, the house-drain could be a great deal smaller than it usually is. A 3-inch pipe is sufficient for a small house, though a 4-

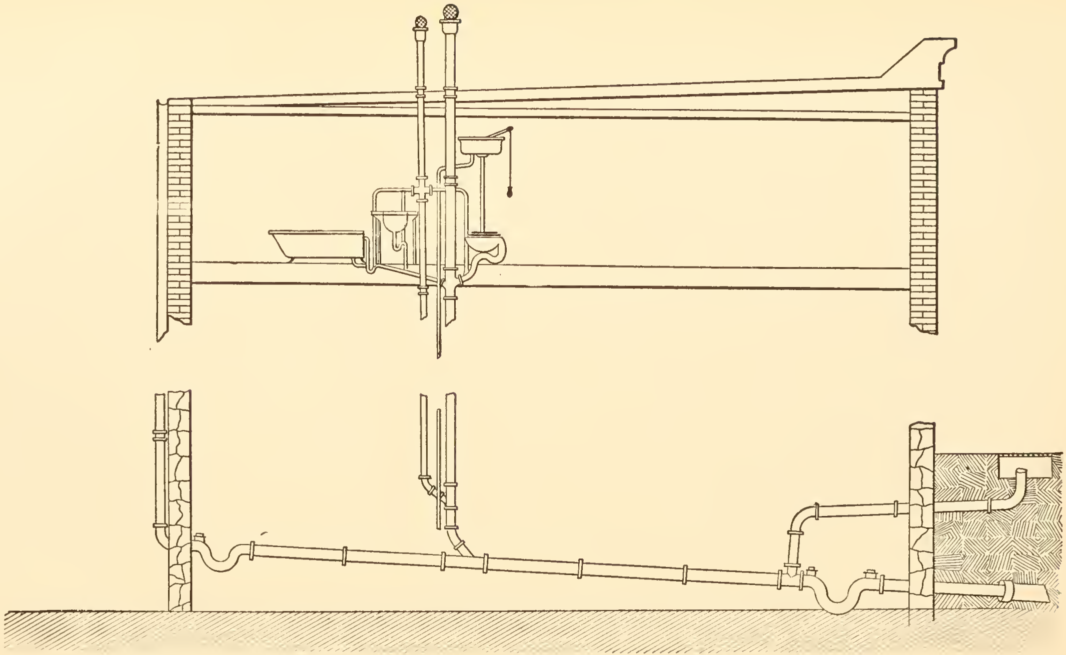


FIG. 18.—SYSTEM OF HOUSE DRAINAGE. SHOWING THE PLUMBING OF A HOUSE. (H BRAMLEY.)

House-drain with running-trap and two handholes, connections with house-sewer and fresh-air inlet. Main soil-pipe, with sink, bath-tub and water-closet trapped and vented; also main vent extended above roof, the soil- and vent-pipe openings on roof protected with wire baskets. The pipe on the left outside of the wall is the rain-leader trapped at its base. The main waste-pipe has been omitted.

inch pipe is made obligatory in most cities; in very large buildings a 5- or 6-inch pipe is required.

Fall. The fall or inclination of the house-drain depends on its size. Every house-drain must be laid so that it should have a certain inclination toward the house-sewer, so as to increase the velocity of flow in it and make it self-flushing and self-cleansing. The rate of fall should be as follows:

For	4-inch	pipe....	1	in	40	feet
"	5 "	"	1	"	50	"
"	6 "	"	1	"	60	"

Position. The house-drain lies in a horizontal position in the cellar, and should, if possible, be exposed to view. It should be hung on the cellar-wall or ceiling, unless this is impracticable, as when fixtures in the cellar discharge into it; in this case it must be laid in a trench cut in a uniform grade, walled upon the sides with bricks laid in cement, and provided with movable covers and with a hydraulic-cement base 4 inches thick, on which the pipe is to rest. The house-drain must be laid in straight lines, if possible; all changes in direction must be made with curved pipes, the curves to be of a large radius.

Connections. The house-drain must properly connect with the house-sewer at a point 2 feet outside of the outer front vault or area-wall of the building. An arched or other proper opening in the wall must be provided for the drain, to prevent damage by settlement.

All joints of the pipe must be gas-tight, lead-calked joints, as stated before. The junction of the vertical soil-, waste-, and rain-leader pipes must not be made by right-angle joints, but by a curved-elbow fitting of a large radius, or by " Y " branches and 45° bends.

When the house-drain does not rest on the floor, but is hung on the wall or ceiling of the cellar, the connection of the vertical soil- and waste-pipes must have suitable supports, the best support being a brick pier laid 9 inches in cement and securely fastened to the wall.

Near all bends, traps, and connections of other pipes with the house-drain, suitable handholes should be provided, these handholes to be tightly covered by brass screw-ferrules, screwed in and fitted with red lead.

" No steam-exhaust, boiler blow-off, or drip-pipe shall be connected with the house-drain or sewer. Such pipes must first discharge into a proper condensing-tank, and from this a proper outlet to the house-sewer outside of the building must be provided."

Main traps. The disconnection of the house-pipes from the street-sewer is accomplished by a trap on the house-drain near the front wall, inside the house, or just outside the foundation-wall, but usually inside of the house. The best trap for this purpose is the syphon or running-trap. This trap must be constructed with a cleaning handhole on the inside or house side of the trap, or on both sides, and the handholes are to be covered gas-tight by brass screw-ferrules.

Extension of vertical pipes. By the main trap the house-plumbing system is disconnected from the sewer;

and by the traps on each fixture from the air in the rooms; still, as the soil-, waste-, and drain-pipes usually contain offensive solids and liquids which contaminate the air in the pipes, it is a good method to ventilate these pipes. This ventilation of the soil-, waste-, and house-drain pipes prevents the bad effects on health from the odors, etc., given off by the slime and excreta adhering in the pipes, and it is accomplished by two means: 1) by extension of the vertical pipes to the fresh air above the roof, and 2) by the fresh-air inlet on the house-drain.

By these means a current of air is established through the vertical and horizontal pipes.

Every vertical pipe must be extended above the roof at least 2 feet above the highest coping of the roof or chimney. The extension must be far from the air-shafts, windows, ventilators, and mouths of chimneys, so as to prevent air from the pipes being drawn into them. The extension must be not less than the full size of each pipe, so as to avoid friction from the circulation of air. The use of covers, cowls, return-bends, etc., is reprehensible, as they interfere with the free circulation of air. A wire basket may be inserted to prevent foreign substances from falling into pipes.

Fresh-air inlet. The fresh-air inlet is a pipe of about 4 inches in diameter; it enters the house-drain on the house side of the main trap, and extends to the external air at or near the curb, or at any convenient place, at least 15 feet from the nearest window. The fresh-air inlet pipe usually terminates in a receptacle covered by an iron grating, and should be far from any hot-air fur-

nace cold-air box. When clean, properly cared for, and extended above the ground, the fresh-air inlet, in conjunction with the open extended vertical pipe, is an efficient means of ventilating the air in the house-pipes; unfortunately, most fresh-air inlets are constantly obstructed, and do not serve the purpose for which they are made.

The Soil- and Waste-pipes.—The soil-pipe receives liquid and solid sewage from the water-closets and urinals; the waste-pipe receives all waste water from sinks, wash-basins, bath-tubs, etc.

The material of which the vertical soil- and waste-pipes are made is cast iron.

The usual sizes of waste-pipes are 2 and 3 inches; of soil-pipes, 3 and 4 inches. No soil-pipe should be of greater diameter than 4 inches, except in very large buildings.

The joints of the waste- and soil-pipes should be lead-calked. The connections of the lead branch pipes or traps with the vertical lines must be by Y-joints, and by means of brass ferrules, as explained above.

The location of the vertical pipes must never be within the wall, built in, nor outside the house, but preferably in a special 3-foot square shaft adjacent to the fixtures, extending from the cellar to the roof, where the air-shaft should be covered by a louvered skylight; that is, with a skylight with slats outwardly inclined, so as to favor ventilation.

The vertical pipes must be accessible, exposed to view in all their lengths, and, when covered with boards, so fitted that the boards may be readily removed.

Vertical pipes must be extended above the roof in full diameter, as previously stated. When less than 4 inches in diameter, they must be enlarged to 4 inches at a point not less than 1 foot below the roof-surface by an "increaser" of not less than 9 inches long.

All soil- and waste-pipes must, whenever necessary, be securely fastened with wrought-iron hooks or straps.

Vertical soil- and waste-pipes must not be trapped at their base, as the trap would not serve any purpose, and would prevent a perfect flow of the contents.

Branch Soil- and Waste-pipes.—The fixtures must be near the vertical soil- and waste-pipes in order that the branch waste- and soil-pipes should be as short as possible. The trap of the branch soil- and waste-pipes must not be far from the fixture, not more than 2 feet from it, otherwise the accumulated foul air and slime in the waste- and soil-branch will emit bad odors.

The minimum sizes for branch pipes should be as follows:

Kitchen sinks...............	2 inches.
Bath-tubs	$1\frac{1}{2}$ to 2 inches.
Laundry-tubs	$1\frac{1}{2}$ to 2 inches.
Water-closets.........	not less than 4 inches.

Branch soil- and waste-pipes must have a fall of at least $\frac{1}{4}$ inch to 1 foot.

The branch waste- and soil-pipes and traps must be exposed, accessible, and provided with screw-caps, etc., for inspection and cleaning purposes.

Each fixture should be separately trapped as close to the fixture as possible, as two traps on the same line of

branch waste- or soil-pipes will cause the air between the traps to be closed in, forming a so-called " cushion " that will prevent the ready flow of contents.

" All traps must be well supported and rest true with respect to their water-level."

Vent-pipes and their Branches.—The purpose of vent-pipes, we have seen, is to prevent syphoning of traps and to ventilate the air in the traps and pipes. The material of which vent-pipes are made is cast iron.

The size of vent-pipes depends on the number of traps with which they are connected; it is usually 2 or 3 inches. The connection of the branch vent to the trap must be at the crown of the trap, and the connection of the branch vent to the main vent-pipe must be above the trap, so as to prevent friction of air. The vent-pipes are not perfectly vertical, but with a continuous slope so as to prevent condensation of air or vapor therein.

The vent-pipes should be extended above the roof, several feet above coping, etc.; and the extension above the roof should not be of less than 4 inches diameter, so as to avoid obstruction by frost. No return-bends or cowls should be tolerated on top of the vent-pipes. Sometimes the vent, instead of running above the roof, is connected with the soil-pipe several feet above all fixtures.

Rain-leaders.—The rain-leader serves to collect the rain-water from the roof and eaves-gutter. It usually discharges its contents into the house-drain, although some leaders are led to the street-gutter, while others are connected with school-sinks in the yard. The latter practice is objectionable, as it may lead the foul air

from the school-sink into the rooms, the windows of which are near the rain-leader; besides, the stirring up of the contents of the school-sink produces bad odors. When the rain-leader is placed within the house, it must be made of cast iron with lead-calked joints; when

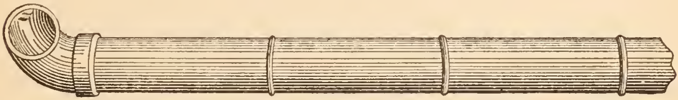


FIG. 18.—LEADER-PIPE.

outside, as is the rule, it may be of sheet metal or galvanized-iron pipe with soldered joints. When the rain-leader is run near windows, the rules and practice are that it should be trapped at its base, the trap to be a deep one to prevent evaporation, and it should be placed several feet below the ground, so as to prevent freezing.

CHAPTER XI.

PLUMBING FIXTURES.

THE receptacles or fixtures within the house for receiving the waste and excrementitious matter and carrying it off through the pipes to the sewer are very important parts of house-plumbing. Great care must be bestowed upon the construction, material, fitting, etc., of the plumbing fixtures, that they be a source of comfort in the house instead of becoming a curse to the occupants.

Sinks.—The waste water from the kitchen is disposed of by means of sinks. Sinks are usually made of cast iron, painted, enamelled, or galvanized. They are also made of wrought iron, as well as of earthenware and porcelain. Sinks must be set level, and provided with a strainer at the outlet to prevent large particles of kitchen-refuse from being swept into the pipe and obstruct it. If possible, the back and sides of a sink should be cast from one piece; the back and sides, when of wood, should be covered by non-absorbent material, to prevent the wood from becoming saturated with waste water. No woodwork should enclose sinks; they should be supported on iron legs and be open beneath and around. The trap of a sink is usually 2 inches in

diameter, and should be near the sink; it should have a screw-cap for cleaning and inspection, and the branch vent-pipe should be at the crown of the trap.

Wash-basins.—Wash-basins are placed in bathrooms, and, when properly constructed and fitted, are a source of comfort. They should not be located in bedrooms, and should be open, without any woodwork around them. The wash-bowls are made of porcelain or marble, with a socket at the outlet, into which a plug is fitted.

Wash-tubs.—For laundry purposes wooden, iron-enamelled, stone, and porcelain tubs are fitted in the kitchen or laundry-room. Porcelain is the best material, although very expensive. The soapstone tub is the next best; it is clean, non-absorbent, and not too expensive. Wood should never be used, as it soon becomes saturated, is foul, leaks, and is offensive. In old houses, wherever there are wooden tubs, they should be covered with zinc or some non-absorbent material. The wash-tubs are placed in pairs, sometimes three in a row, and they are generally connected with one lead waste-pipe $1\frac{1}{2}$ to 2 inches in diameter, with one trap for all the tubs.

Bath-tubs.—Bath-tubs are made of enamelled iron or porcelain, and should not be covered or enclosed by any woodwork. The branch waste-pipe should be trapped and connected with the main waste- or soil-pipe. The floor about the tub in the bathroom should be of non-absorbent material.

Refrigerators.—The waste-pipes of refrigerators should not connect with any of the house-pipes, but

should be emptied into a basin or pail; or, if the refrigerator is large, its waste-pipe should be conducted to the cellar, where it should discharge into a properly-trapped, sewer-connected, water-supplied, open sink.

Boilers.—The so-called sediment-pipe from the hot-water boiler in the kitchen should be connected with the sink-trap at the inlet side of the trap.

Urinals.—As a rule, no urinals should be tolerated within a house; they are permissible only in factories and office buildings. The material is enamelled iron or porcelain. They must be provided with a proper water-supply to flush them.

Overflows.—To guard against overflow of wash-basins, bath-tubs, etc., overflow-pipes from the upper portion of the fixtures are commonly provided. These pipes are connected with the inlet side of the trap of the same fixture. They are, however, liable to become a nuisance by being obstructed with dirt and not being constantly flushed; whenever possible they should be dispensed with.

Safes and Wastes.—A common usage with plumbers in the past has been to provide sinks, wash-basins, bath-tubs, and water-closets, not only with overflow-pipes, but also with so-called safes, which consist of sheets of lead turned up several inches at the edges so as to catch all drippings and overflow from fixtures; from these safes a drip-pipe or waste is conducted to the cellar, where it empties into a sink. Of course, when such safe-wastes are connected with the soil- or waste-pipes, they become a source of danger, even if they are trapped, as they are not properly cared for or

flushed; and their traps are usually not sealed. Even when discharging into a sink in the cellar, safes and safe-waste are very unsightly, dirty, liable to accumulate filth, and are offensive. With open plumbing, and with the floors under the fixtures of non-absorbent material, they are useless.

Water-closets.—The most important plumbing fixture in the house is the water-closet. It is of the greatest importance that the water-closet be placed in a separate apartment, and not in the kitchen or any other room of the house. This apartment should be well lighted and ventilated. The most advanced regulations in this respect are the rules of the Tenement-house Law of New York (1901):

> "There shall be a separate water-closet in a separate compartment within each apartment. All water-closet compartments must have a window opening upon the street, yard, court, or vent-shaft. The floor of every water-closet compartment shall be made waterproof with asphalt, cement, tile, stone, metal or some other waterproof material; and such waterproofing shall extend at least six inches above the floor, so that the floor can be washed or flushed without leaking. No drip-tray shall be permitted. No water-closet fixture shall be enclosed with woodwork."

There are many water-closets on the market, some bad, some indifferent, and some good.

The pan closet. The water-closet most commonly used in former times was a representative of the group of water-closets with mechanical contrivances. This is the *pan closet*, now universally condemned and prohibited from further use. The pan closet consists of 4 principal parts: 1) a basin, of china, small and round; 2) a copper 6-inch pan under the basin; 3) a large iron container, into which the basin with the pan under it is

placed; and 4) a D trap to which the container is joined. The pan is attached with a lever to a handle, which, when pulled, moves the pan, this describes a half circle

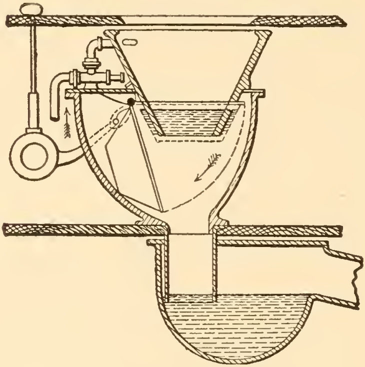


FIG 19.—PAN WATER-CLOSET.

and drops the contents into the container and trap. The objections to pan closets are the following:

1) There being a number of parts, and mechanical contrivances, they are liable to get out of order.

2) The bowl is set into the container and cannot be inspected, and is usually very dirty beneath.

3) The pan is often missing, gets out of order, and is liable to be soiled by adhering excreta.

4) The container is large, excreta adhere to its upper parts, and the iron becomes corroded and coated with filth.

5) With every pull of the handle and pan, foul air enters rooms.

6) The junctions between the bowl and container, and the container and trap, are usually not gas-tight.

7) The pan breaks the force of the water flush, and the trap is usually not completely emptied.

Valve and plunger closets are an improvement upon the pan closets, but are not free from several objections enumerated above. As a rule, all water-closets with mechanical parts are objectionable.

Hopper closets are made of iron or earthenware. Iron

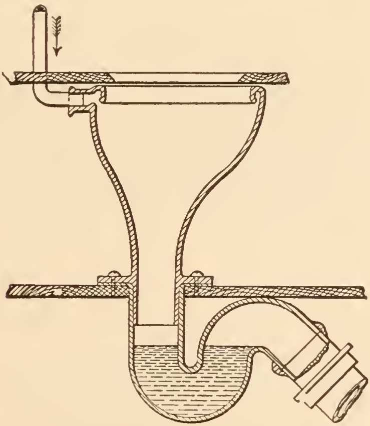


FIG. 20.—LONG HOPPER WATER-CLOSET.

hopper closets easily corrode; they are usually enamelled on the inside. Earthenware hoppers are preferable to iron ones. Hopper closets are either long or short; when long, they expose a very large surface to be fouled, require a trap below the floor and are, as a rule, very difficult to clean or to keep clean. Short hopper closets are preferable, as they are easily kept clean and are well flushed. When provided with flushing-rim, and with a good water-supply cistern and large

supply-pipe, the short hopper closet is a good form of water-closet.

The washout and washdown water-closets are an improvement upon the hopper closets. They are manufactured from earthenware or porcelain, and are so

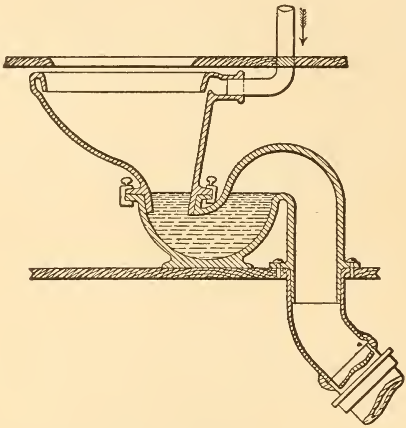


FIG. 21.—SHORT HOPPER WATER-CLOSET.

shaped that they contain a water-seal, obviating the necessity of a separate trap under the closet.

Cisterns. Water-closets must not be flushed directly from the water-supply pipes, as there is a possibility of contaminating the water-supply. Water-closets should be flushed from special cisterns, either of iron or of wood metal lined; these cisterns should be placed not less than 4 feet above the water-closet, and provided with a straight flush-pipe of at least $1\frac{1}{4}$ in. diameter.

The cistern is fitted with plug and handle, so that by pulling at the handle the plug is lifted out of the

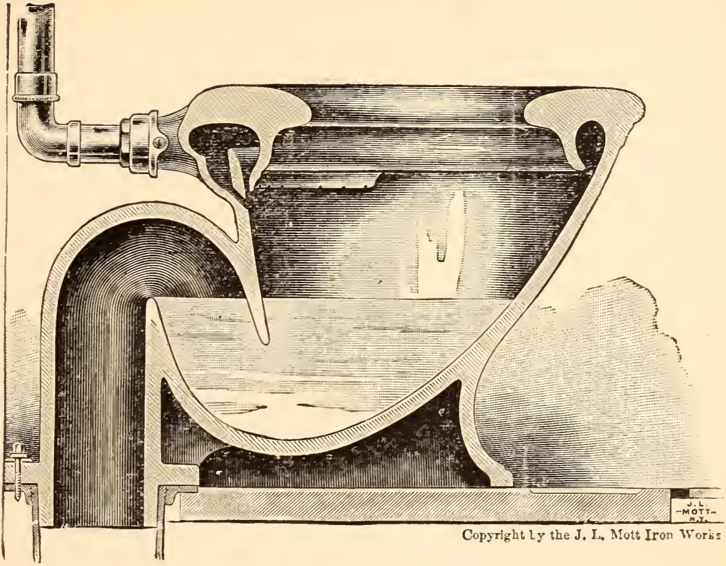


FIG. 22.—WASHDOWN WATER-CLOSET.

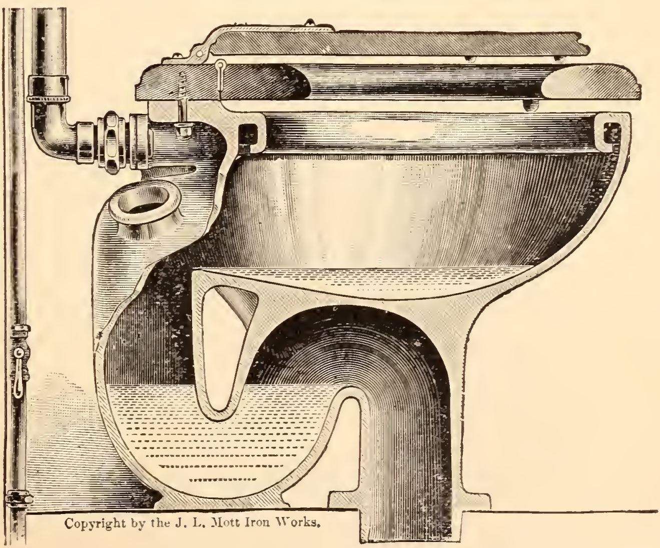


FIG. 23.—WASHOUT WATER CLOSET.

socket of the cistern and the contents permitted to rush through the pipe and flush the water-closet. A separate ball arrangement is made for closing the water-supply when the cistern is full. The cistern must have a capacity of at least 3–5 gallons of water; the flash-pipe

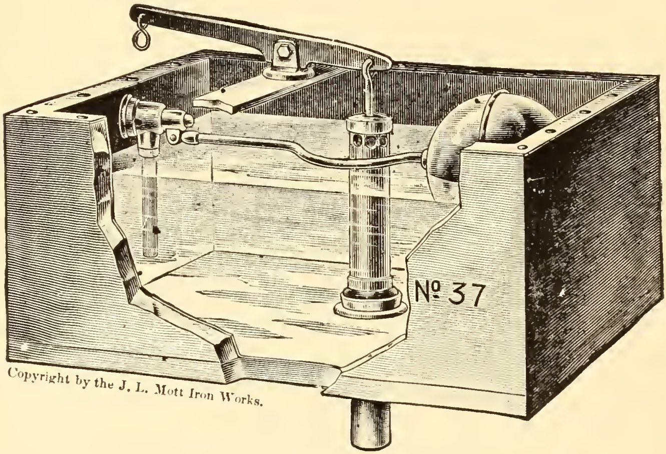


FIG. 24.—FLUSHING CISTERN.

must have a diameter of not less than one and one-quarter inch, and the pipe must be straight, without bends, and the arrangement within the closets such as to flush all parts of the bowl at the same time.

Yard Closets.—In many old houses the water-closet accommodations are placed in the yard. There are two forms of these yard closets commonly used; the School-sink and the Yard Hopper.

The *school-sink* is an iron trough from 5 to 12 or more feet long, and 1 to 2 feet wide and 1 foot deep, set in a trench several feet below the surface, with an inclin-

ation toward the exit; on one end of the trough there is a socket fitted with a plug, and on the other a flushing apparatus consisting simply of a water service-pipe.

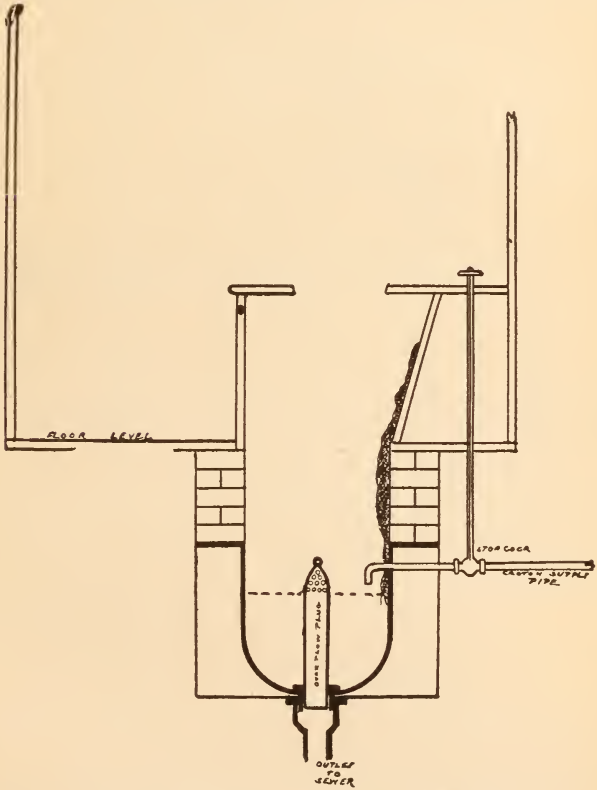


FIG. 25.—SCHOOL SINK AFTER SEVERAL MONTHS' USE. (J. SULLIVAN.)

Above the iron trough brick walls are built up, enclosing it; over it are placed wooden seats, and surrounding the whole is a wooden shed with compartments for

every seat. The excreta are allowed to fall into the trough, which is partly filled with water, and once a day, or as often as the caretaker chooses, the plug is pulled up and the excreta allowed to flow into the sewer with which the school-sink is connected. These school-sinks are, as a rule, a nuisance, and are dangerous to health. The objections to them are the following:

1) The excreta lies exposed in the iron trough, and may decompose even in one day; and it is always offensive.

2) The iron trough is easily corroded.

3) The iron trough, being large, presents a large surface for adherence of excreta.

4) The brickwork above the trough is not flushed when the school-sink is emptied, and excreta which usually adheres to it decomposes, creating offensive odors.

5) The junction of the iron trough with the brickwork, and the brickwork itself, is usually defective, or becomes defective, and allows foul water and sewage to pass into the yard, or into the wall adjacent to the school-sink. By the Tenement-house Law of New York, after 1903 the use of school-sinks is prohibited even in old buildings.

Yard hopper closets. Where the water-closet accommodations cannot, for some reason, be put within the house, yard hopper closets are commonly employed. These closets are simply long, iron enamelled hoppers, trapped, and connected with a drain-pipe discharging into the house-drain. These closets are flushed from cisterns, but, in such case, the cisterns must be protected from freezing; this is accomplished in some

houses by putting the yard hopper near the house and placing the cistern within the house; however, this can hardly be done where several hoppers must be employed. In most cases, yard hoppers are flushed by automatic

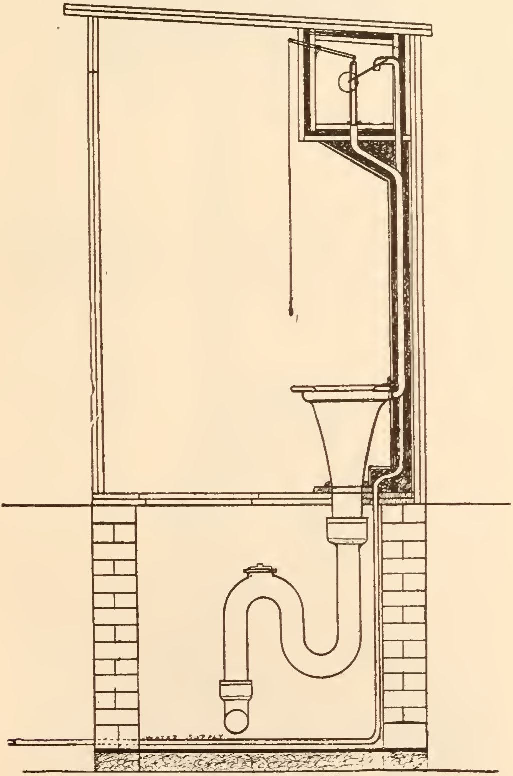


Fig. 26.—J. Sullivan's Improved Yard Hopper Closet.

rod-valves, so constructed as to flush the bowl of the hopper whenever the seat it pressed upon. These valves, as a rule, frequently get out of order and leak, and care

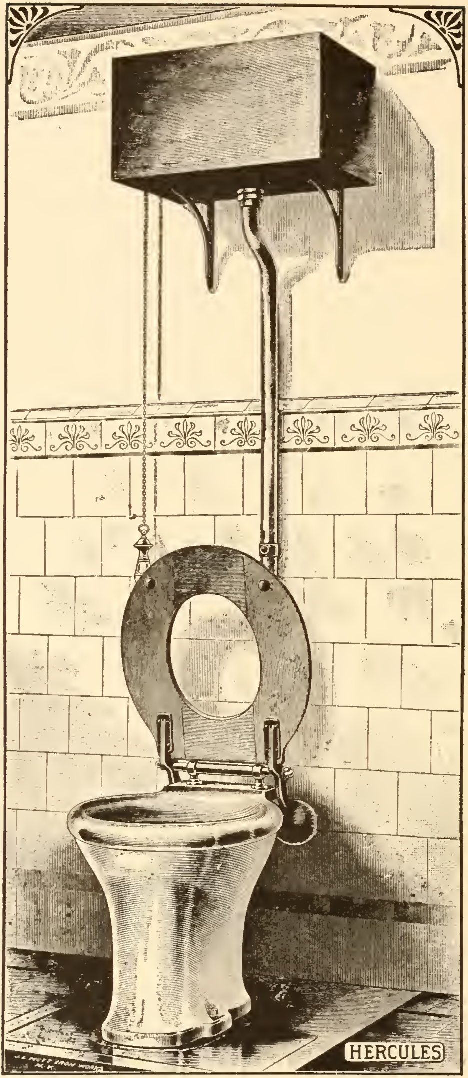


Fig. 27.—A Modern Water-closet. (L. J. Mott Iron Works.)

must be taken to construct the vault under the hoppers so that it be perfectly water-tight. The cut on page 101 represents an improved form of yard hopper suggested by Inspector J. Sullivan, of the New York Health Department, and used in a number of places with complete satisfaction. The improvement consists in the doors and walls of the privy apartment being of double thickness, lined with builders' lining on the inside, and the water-service pipes and cistern being protected by felt or mineral wool packing.

Yard- and Area-drains.—The draining of the surface of the yard or other areas is done by tile or iron pipes connecting with the sewer or house-drain. Every such drain should be trapped, not with a bell- or a lip-trap, but by a common syphon; or, better, the gully and trap are made of one piece.

CHAPTER XII.

DEFECTS IN PLUMBING; EXAMINATION AND TESTS.

The materials used in house-plumbing are many and various, the parts are very numerous, the joints and connections are frequent, the position and location of pipes, etc., are often inaccessible and hidden, and the whole system quite complicated. Moreover, no part of the house construction is subjected to so many strains and uses, as well as abuses, as the plumbing of the house. Hence, in no part of house construction can there be as much bad work and "scamping" done as in the plumbing; and no part of the house is liable to have so many defects in construction, maintenance, and condition as the plumbing. At the same time, the plumbing of a house is of very great importance and influence on the health of the tenants, for defective materials, bad workmanship and improper condition of the plumbing of a house may endanger the lives of its inhabitants by causing various diseases.

Defects in Plumbing.—The defects usually found in plumbing are so many that they cannot all be enumerated here. Among the principal and most common defects, however, are the following:

Materials. Light-weight iron pipes; these crack easily and cannot stand the strain of calking. Sandholes made during casting; these cannot always be detected, especially when the pipes are tar-coated. Thin lead pipe, not heavy enough to withstand the bending and drawing it is subjected to.

Location and Position. Pipes may be located within the walls and built in, in which case they are inaccessible, and may be defective without any one being able to discover the defects. Pipes may be laid with a wrong or an insufficient fall, thus leaving them unflushed, or retarding the proper velocity of the flow in the pipes. Pipes may be put underground and have no support underneath, when some parts or lengths may sink, get out of joint and the sewage run into the ground instead of through the pipes. The pipes may be so located as to require sharp bends and curves, which will retard the flow in them.

Joints. Joints in pipes may be defective, leaking and not gas-tight, because of imperfect calking, insufficient lead having been used; or, no oakum having been used and the lead running into the lumen of the pipe; or, not sufficient care and time being taken for the work. Joints may be defective because of iron ferrules being used instead of brass ferrules; through improperly wiped joints; through bad workmanship, bad material, or ignorance of the plumber. Plumbers often use T branches instead of Y branches; sharp bends instead of bends of 45 degrees or more; slip joints instead of lead-calked ones; also, they often connect a pipe of larger diameter with a pipe of small diameter, etc., etc.

Traps. The traps may be bad in principle and in construction; they may be badly situated or connected, or they may be easily unsealed, frequently obstructed, inaccessible, foul, etc.

Ventilation. The house-drain may have no fresh-air inlet, or the fresh-air inlet may be obstructed; the vent-pipes may be absent, or obstructed; the vertical pipes may not be extended.

Condition. Pipes may have holes, may be badly repaired, bent, out of shape, or have holes patched up with cement or putty; pipes may be corroded, gnawed by rats, or they may be obstructed, etc., etc.

The above are only a few of the many defects that may be found in the plumbing of a house. It is, therefore, of paramount importance to have the house-plumbing regularly, frequently, and thoroughly examined and inspected, as well as put to the various tests, so as to discover the defects and remedy them.

Plumbing Tests.—The following are a few minor points for testing plumbing:

1) To test a trap with a view to finding out whether its seal is lost or not, knock on the trap with a piece of metal; if the trap is empty, a hollow sound will be given out; if full, the sound will be dull. This is not reliable in case the trap is full or half-full with slime, etc. Another test for the same purpose is as follows: Hold a light near the outlet of the fixture; if the light is drawn in, it is a sign that the trap is empty.

2) Defects in leaded joints can be detected if white lead has been used, as it will be discolored in case sewer-gas escape from the joints.

3) The connection of a waste-pipe of a bath-tub with the trap of the water-closet can sometimes be discovered by suddenly emptying the bath-tub and watching the contents of the water-closet trap; the latter will be agitated if the waste-pipe is discharged into the trap or on the inlet side of trap of the water-closet.

4) The presence of sewer-gas in a room can be detected by the following chemical method: Saturate a piece of unglazed paper with a solution of acetate of lead in rain or boiled water, in the proportion of 1 to 8; allow the paper to dry and hang up in the room where the escape of sewer-gas is suspected; if sewer-gas is present, the paper will be completely blackened.

The main tests for plumbing are: 1) The *Hydraulic*, or water-pressure test; 2) the *Smoke*, or sight test; and 3) the *Scent*, or peppermint, etc., test.

The Water-pressure Test is used to test the vertical and horizontal pipes in new plumbing before the fixtures have been connected. It is applied as follows: The end of the house-drain is plugged up with a proper air-tight plug, of which there are a number on the market. The pipes are then filled with water to a certain level, which is carefully noted. The water is allowed to stand in the pipes for half an hour, at the expiration of which time, if the joints show no sign of leakage, and are not sweating, and if the level of the water in the pipes has not fallen, the pipes are water-tight. This is a very reliable test, and is made obligatory for testing all new plumbing work.

The Smoke Test is also a very good test. It is applied

as follows: By means of bellows, or some exploding, smoke-producing rocket, smoke is forced into the system of pipes, the ends plugged up, and the escape of the smoke watched for, as wherever there are defects in the pipes the smoke will appear. A number of special appliances for this test are manufactured, all of them more or less ingenious.

The Scent Test is made by putting into the pipes a certain quantity of some pungent chemical, like peppermint-oil, etc., the odor of which will escape from the defects in the pipes if there are any. Oil of peppermint is commonly used in this country for the test. The following is the way this test is applied: All the openings of the pipes on roof, except one, are closed up tightly with paper, rags, etc. Into the one open pipe is poured from 2 to 4 ounces of peppermint-oil, followed by a pail of hot water, and then the pipe into which the oil has been put is also plugged up. This is done preferably by an assistant. The inspector then proceeds to slowly follow the course of the various pipes, and will detect the smell of the oil wherever it may escape from any defects in the pipes. If the test is thoroughly and carefully done, if care is taken that no fixture in the house is used and the traps of same not disturbed during the test, if the openings of the pipes on the roofs are plugged up tightly, if the main house-trap is not unsealed (otherwise the oil will escape into the sewer), and if the handling of the oil has been done bv an assistant, so that none adheres to the inspector; if all these conditions are carried out, the pepper-

mint test is a most valuable test for the detection of any and all defects in plumbing. Another precaution to be taken is with regard to the rain-leader. If the rain-leader is not trapped, or if its trap is empty, the peppermint-oil may escape from the pipes into the rain-leader. Care must be taken, therefore, that the trap at the base of the rain-leader be sealed; or, if no trap is existing, to close up the connection of the rain-leader with the house-drain; or, if this be impossible, to plug up the opening of the leader near the roof.

Instead of putting the oil into the opening of a pipe on the roof, it may be put through a fixture on the top floor of the house, although this is not so satisfactory.

Various appliances have been manufactured to make this test more easy and accurate. Of the English appliances, the Banner patent drain-grenade, and Kemp's drain-tester are worthy of mention. The former consists "of a thin glass vial charged with pungent and volatile chemicals. One of the grenades, when dropped down any suitable pipe, such as the soil-pipe, breaks, or the grenade may be inserted through a trap into the drain, where it is exploded." (Taylor.) Kemp's drain-tester consists of a glass tube containing a chemical with a strong odor; the tube is fitted with a glass cover, held in place by a spring and a paper band. When the tester is thrown into the pipes and hot water poured after it, the paper band breaks, the spring opens the cover, and the contents of the tube fall into the drain.

Recently Dr. W. G. Hudson, an inspector in the De-

partment of Health of New York, has invented a very ingenious "peppermint cartridge" for testing plumbing. The invention is, however, not yet manufactured, and is not on the market.

PART SECOND.

SANITARY PRACTICE.

CHAPTER I.

THE TENEMENT-HOUSE PROBLEM.

"Man, in constructing protection from exposure, has constructed conditions of disease. In an age when he could not foresee the results of his own work, he created these conditions, and it is not fair to blame him, because he did not, in his primitive days, know better. We do know better now, and it is our fault if we do not improve on the original bad work, rectify it and remove intelligently the evils which, from deficient intelligence, have been so long perpetuated. This should be the uniform object of the sanitary scholar. The intention (and object) of domestic sanitation is so to construct homes for human beings, or, if the homes be constructed, so to improve them, that the various diseases and ailments incident to bad construction may be removed to the fullest possible extent."

BENJAMIN W. RICHARDSON, in *Health in the Home.*

THE above words of Dr. Richardson are the quintessence of the tenement-house problem and its solution.

In ignorance, in folly, and in carelessness, society had permitted certain conditions to exist and be perpetuated; conditions vitally affecting life and health, and which have been allowed to become a fearful menace to social prosperity.

In the relentless march of industrial progress and the fierce struggle for commercial superiority, modern cities have developed evils which threaten to undermine the very existence of urban life, and have created conditions which threaten to cause the extinction of these cities by depopulating them through disease and plague, due to defective sanitation.

Owing to various causes, a very large proportion (in New York State 71%, according to the last census) of the population of the country is concentrated in cities; a great part of the city inhabitants is herded in small, confined areas; the majority of the urban population is compelled to crowd into the vast barrack-like structures called tenements, defective in construction, unsanitary in drainage, faulty in condition, and lacking in light, air, and water—the three essentials of life.

These conditions cause the large average mortality of cities, the fearful slaughter of innocent infants and children, the dwarfing of the constitutions of the growing generation, the spreading of infection and contagion, the degenerating of the intellectual and the corrupting of the moral life of the community.

The houses men live in bear an intimate relation with soil, light, air, water, and drainage; and the influence of these upon health has already been spoken of. Moreover, the construction of houses, overcrowding, and the density of population, have each a direct influence on man's health and longevity.

Tuberculosis, the scourge of nations, is a disease of over-crowded tenements; typhoid fever is a disease of defective drainage; the diarrhœas from which so many

thousands of babies die every summer are tenement-house diseases. Rheumatism is a disease of damp and dark dwellings; smallpox, scarlet fever, and other human plagues spread like wildfire in crowded, ill-constructed, ill-ventilated, badly-lighted, and miserable tenement districts.

There are blocks in New York City with one thousand human beings to the square acre. There are blocks solidly built upon, with not more than 10% space left for air and light. There are barracks (miscalled houses) in which not less than 36 families make their home. There are floors in 25 × 100-lot houses with 6 families to a floor. There are apartments of 2 or 3 rooms each, containing 10 to 15 persons.

Where there is such density of population, there cannot be sufficient light, air, or breathing space; hence the sanitary conditions are often horrible beyond description, and the moral pollution vile beyond mention.

Here are a few figures from statistics on the influence of dwellings upon health.

Dr. Farr gives the following on mortality and density of population (Notter and Firth):

86 people to the square mile....	14 in 1000
172 " " " " "	17 " "
255 " " " " "	20 " "
1128 " " " " "	23 " "
3399 " " " " "	26 " "

Dr. Anderson, Medical Officer of Dundee, gives the following figures on the comparative death-rates of

inhabitants of one-, two-, three-, and four-room apartments (Dr. Sykes, Brit. Med. Jour.):

One-room	apartments....	21.4 in	1000
Two-room	"	18.8 "	"
Three-room	"	17.2 "	"
Four-room	"	12.3 "	"

According to the New York Tenement Report of 1894, the death-rate in New York in the First Ward in single houses on one lot was 29.03; and in lots where there were front and rear houses the death-rate reached 61.97! In the same ward the death-rate of children under 5 years of age reached, in the former, 109.58, and in the latter the terrible rate of 204.55 in a thousand! It is hardly necessary to cite more figures to prove that overcrowding and high death-rate walk hand in hand.

The tenement-house is an offspring of municipal neglect, of overcrowding in small areas, of industrial expansion, of commercial encroachment, of poverty and destitution, of deficient transportation, and of the necessity of the working classes to dwell near their industrial occupations.

Originally, the tenement-houses consisted of former private dwellings, whose occupants, being crowded out by commerce and manufacture, left them and moved into less crowded locations, leaving their houses to be occupied by the less fortunate, who were compelled to remain near their work. As population pressed on, these spacious houses were divided and sub-divided without any control or regard to light and ventilation;

hence, many apartments were soon overfilled, and the demand for such homes induced the wide-awake real-estate men to build houses expressly for poor tenants. That these buildings were constructed with no regard for proper sanitation, etc., goes without saying; for in those times there were no restricting laws, and every builder and speculator constructed houses with the sole idea of the number of families that could possibly be crowded in, and the largest amount of rent that could possibly be gotten out of them.

It was then that the cry of the philanthropists went up (*vide* first report of the "Committee on Housing" of the Association for the Improvement of the Poor, 1853): "Pure air, light, and water, being indispensable to health and life, if tenements are so badly constructed as to preclude a proper supply of these essential elements, the *law* should interpose for the protection of the sufferers, and either *close up* such dwellings, or cause them to be remodelled so as to be fit for human habitations."

But for a long, a very long time, this was only a cry in the wilderness, and tenements continued to spring up without regard to the "essential elements." At last, in the middle seventies, a law was passed by the State legislature restricting uncontrolled tenement construction, and from that time onward progressive changes and laws were made in behalf of tenement improvement; not, however, without various selfish interests interposing hindrances, objecting to the so-called tyrannical socialistic tendencies of tenement legislation, and doing all possible to counteract the growing ten-

dency for tenement reform. But, in spite of all these, the better elements of society have gained the upper hand, and the evils of unsanitary tenements have been curtailed in many cities, and especially in New York, by the wise and beneficent laws of 1887, 1895, and by the last and crowning model tenement-house law of 1901.

Hand in hand with those beneficial laws are the provisions for their enforcement by the proper municipal departments.

The proper solution of the tenement-house problem is, therefore: Legislation, Restriction, Strict Supervision, Careful Inspection, Constant Vigilance and *the rigid and impartial enforcement of all existing laws now on the statute books;* and last, though not least, the inculcating of habits of personal cleanliness among the masses of the foreign population, who constitute so large a proportion of tenement-house dwellers; for there is no doubt that lazy, indolent, dirty, ignorant or malicious tenants often are as much responsible for the unsanitary conditions existing in tenements as are indifferent, grasping owners or lessees.

CHAPTER II.

TENEMENT-HOUSES.

Classes.—There are several classes of tenements, according to their construction, tenants, plumbing, etc.

The definition of "tenement" is as follows (Sec. 2, T. H. L.):

"A tenement-house is any house or building, or portion thereof, which is rented, leased, let or hired out, to be occupied as the home or residence of three families or more living independently of each other, and doing their cooking upon the premises, or by more than two families upon one floor, so living and cooking, but having a common right in the halls, stairways, yards, water-closets or privies, or some of them."

Under this heading are included all houses having three families or more; therefore, the so-called "flats" and apartment-houses are tenement-houses in the eyes of the law. A classification, according to the monthly rents of the tenants, has been made by the law (wherever the law, or tenement-law, etc., are mentioned, the New York tenement-house law is meant); thus, houses, the apartments of which average a monthly rental of more than $25, are not required to be inspected every month, as are other tenements.

The cheaper tenement-houses are different in con-

TYPES OF TENEMENT-HOUSES.

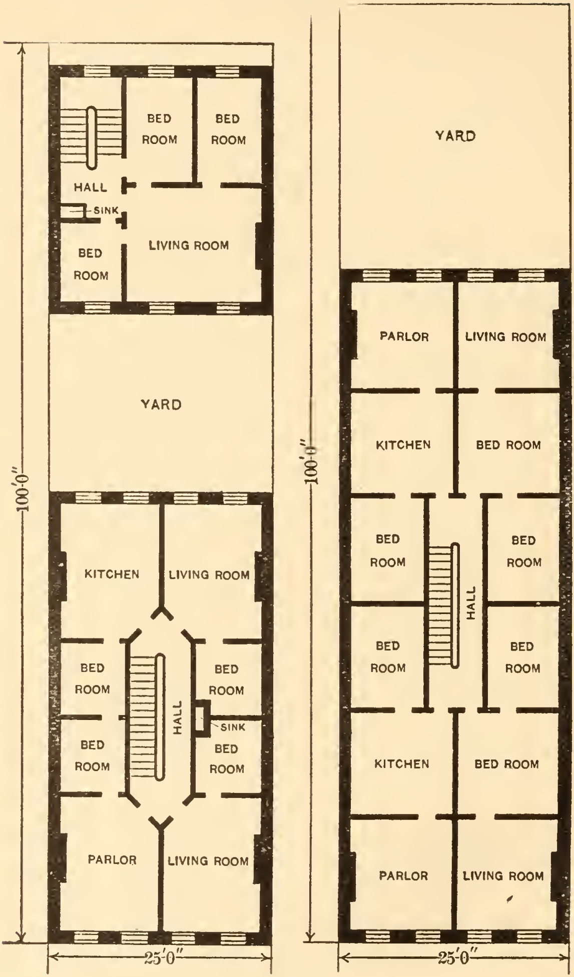


FIG. 28.

1. Front and rear house on one lot.

2. Type of tenement-house without light or ventilation, except in outer rooms.

(From Report of the Tenement-house Commission, 1894.)

TYPES OF TENEMENT-HOUSES.

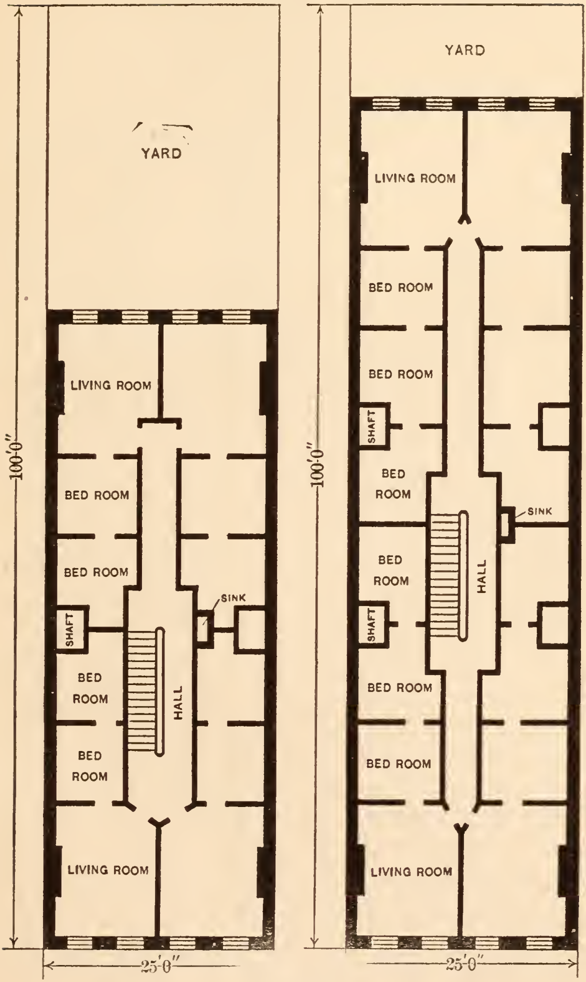


FIG. 28.

3. Type of tenement, showing introduction of light shaft.

4. Typical double-decker of the old style, covering 90 per cent of the lot.

(From Report of the Tenement-house Commission, 1894.)

TYPES OF TENEMENT-HOUSES.

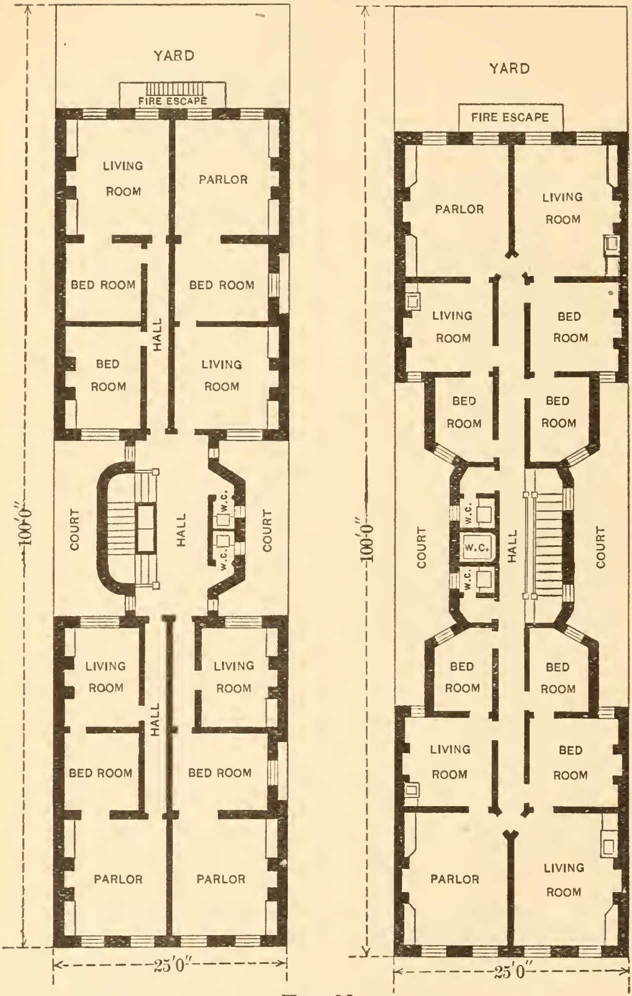


Fig. 28.

5 and 6. Improved tenement-houses after 1879.

(From Report of the Tenement-house Commission, 1894.)

struction, according to their age and the laws under which they were constructed. Hence the variety in tenement-house construction, as seen in the floor-plans of the principal classes of these buildings.

Tenements may be classified also according to their plumbing: such as houses without plumbing at all; houses with water service and sinks in halls only; houses with sinks in rooms and privy accommodations in halls, and houses with both within the apartments.

Sites.—Tenement-house dwellers can hardly choose the site upon which the house they live in is situated. The same conditions which cause the laboring man to live in overcrowded portions of the city, also compel him to live in certain streets, blocks and houses, without regard to the sanitary conditions of the site—proximity to his work and the amount of rent he is able to pay being the determining factors. The ground upon which the house is situated has a great influence on the health of the occupant, but the tenant is compelled to take what is offered without any choice on his part. Houses built upon made land and upon marshy soil are, as a rule, damp and unhealthy. Cities with river fronts have shores which are usually low, hence a certain part of the city ground formerly covered by water may have been regained by being filled in with rubbish and refuse. Houses on such land are usually damp, unless the most scientific precautions have been taken during their construction; but, as this is seldom the case, and, as in a great many, if not most, of these houses, the cellars are not concreted, it follows that they are damp, and at times full of water. Certain

streets in New York City, such as: South, Water, Front, Cherry, Broad, West, Washington, Greenwich (partly), Tenth and Eleventh Avenues, Lewis, Goereck, Mangin, etc., are wholly or partly on made ground; and a great many other places were originally marsh land and watercourses subsequently filled in. That houses built on these sites cannot be as healthy as those built upon rocky or upon meadow land, is obvious.

Construction.—The proper construction, that is, the masonry, carpentry, and brickwork, etc., of the tenement-house is important, but as a great many, if not the majority, of tenements are built by speculators, good workmanship cannot be expected, and the houses are damp, with walls cracking, ceilings peeling and falling, roofs leaking, plumbing out of order, etc.

Percentage of Lot Occupied.—The common 25 × 100-ft. New York lot is, as a rule, well built upon, only so much of it being left as is absolutely demanded by law. The 1901 law prescribes that only 70% of an ordinary lot and 90% of a corner lot may be built upon.

Protection against Fire.—The law (see Part 4) contains some model and progressive points in this direction. An important condition mentioned therein is the number, position, and condition of the fire-escapes.

Warming.—The cheaper classes of tenements have no heating arrangements for the whole house, each apartment being heated by stoves or ranges belonging to the tenant or landlord. As the apartments are of three or four rooms, commonly in one row, with the stoves situated in the kitchen, the result is that the rooms are disproportionately heated, the kitchen being super-

heated, and the rest of the rooms too cold, necessitating their being closed up in winter. The better class of houses have hot-water or steam heating, either for the halls alone or for the rooms as well. A nuisance often complained of with regard to steam heating is the noise (water-hammer) made by air and water lodged in pipes. This difficulty is obviated by having the flow- and the return-pipes carried in as direct a line as possible, and having the coils on the return-pipes.

Lighting.—Excepting corner houses, most tenements get their light only from their street side, the rear being obstructed by the houses on the adjacent lots of the next street, the intervening space being filled with washlines and drying clothes. The kitchen and bedrooms are commonly lighted by air-shafts and courts, which give only a dim light, and that only for the apartments in the upper stories. The halls are lighted by skylights, and a great many houses have no other light in the halls, as the number of tenements with windows in halls, is not as yet in the majority. Some old houses have entirely dark halls, and it is in those houses, as a rule, that the sinks are in the halls and are used in common by the four families on the floor. The artificial light commonly used in halls is illuminating gas, although there are yet a number of houses which have not even this improvement. The illuminating-gas pipes are sometimes a source of nuisance by leakage therefrom. The defects should be immediately repaired.

Ventilation.—No special provision is made for ventilating tenement-houses, the windows, doors, and chim-

neys serving as the natural means of tenement ventilation. There are a number of houses where there are rooms that have no windows whatever except those opening into the adjacent room. However, the day of these houses and rooms has passed, and the law at present requires that every room must have windows of certain dimensions exposed to the outer air. Cellars are ventilated by windows, gratings, and doors. Water-closet apartments need good ventilation, but many of these apartments in old houses are not ventilated at all, or have a makeshift of a narrow sheet-metal tube 12 inches square—an outlet entirely inadequate for the purpose. The law now compels owners to ventilate water-closet apartments by windows of ample dimensions, and these apartments must have a certain area-space, a requirement not heretofore enforced. The areas of yards, courts, air-shafts, etc., have all been increased by the law with a view to improving the ventilation of tenements. The ventilation of rooms depends on their size (floor area) and cubic feet of air-space. If the rooms are too small, or are overcrowded, no natural change of air, sufficient to clear the confined space from the impurities due to respiration, is possible.

"In every tenement-house hereafter erected, all rooms except water-closet and bath apartments shall have the following sizes: In each apartment there shall be at least one room containing at least 120 square feet of floor area, and each other apartment shall contain at least 70 square feet of floor-space. Each room shall be in every part not less than 9 feet high. . . . No room which does not open with a window into the street, yard, or shaft of at least 25 square feet in area, shall be occupied, unless

such room contains at least 60 square feet of floor-space, and also 600 cubic feet of air-space, and no such room shall be occupied unless there are 600 cubic feet of air to each individual occupying it."

These provisions of the law, although they do not solve the problem of ventilation of tenements, are in the right direction, and will do much to alleviate the sufferings of the tenement-dweller gasping for air.

Water-supply.—Owners of houses are compelled to furnish an adequate supply of water for all domestic purposes, and each and every floor must be provided with proper fixtures to distribute it. In some old houses the main water-service pipe, originally intended for one family, is made to serve for a number of families, and is inadequate, not being sufficient to supply water to the upper floors. The remedy is a water-pipe of larger size. In houses of 4 or more stories the ordinary street pressure is not sufficient to raise the water to the upper floors, and it is then necessary to instal gas, gasoline or steam-engines to pump water into tanks above the highest floor, from whence it is supplied to the upper floors. These tanks may become a source of nuisance, as they may leak and cause dampness of ceilings of the upper story, or furnish dirty water from sediments and dirt gaining access thereto. Tanks should be properly constructed, water-tight, well covered, accessible, easily cleaned, and frequently emptied, scrubbed and cleaned. The overflow from the tank must not discharge into the rain-leader, or into other house-pipes, but should be led down into the cellar to discharge into a sink. The washers on the water-faucets must be renewed once in a while to prevent leakage.

Plumbing.—The plumbing of a tenement-house does not differ from the house-plumbing described in the first part, except in so far as the tenement-houses are built for poor people and all the materials, plumbing included, are of inferior grades, and the workmanship cheaper and inferior.

One of the most dangerous defects in tenement-house plumbing is the old brick or earthenware house-drains. These drains are too large, laid without any fall, and situated underground, with the joints unsupported and broken, and with great holes here and there —the whole a channel of indescribable filth, giving off miasmatic effluvia, saturating the cellar-ground with liquid sewage, poisoning the air in cellar and house, and causing disease and pestilence. Whenever such drains are found they should be ordered out, as even the best of them are not without danger, and the law now prohibits any but extra heavy iron pipe-drains in houses. There is scarcely an earthenware house-drain that will stand a properly applied test.

The iron house-drains in tenements are often underground, owing to the presence of fixtures in the cellar; in such a case an examination of the house-drain is not possible without a test. Plumbers in cleaning house-drains of obstructions are in the habit of leaving open holes in the drains, or, if they take the trouble to close the holes, they do so with sheet-metal, putty, or cement, or sometimes with only a rag tied around the pipe. These openings are a means of escape for sewer-air. They should be closed gas-tight with iron bands, patent saddle-hubs, or screw-nuts. The covers of the handholes

of traps on house-drains should be gas-tight adjusted. Very frequently there will be found connected with the house-drain the overflow pipes from refrigerators, roof-tanks, waste-pipes from stores, pressure-pumps from beer-saloons, etc. All such pipes must be disconnected from the house-drain, the opening at the disconnected place closed gas-tight, and the waste-pipes made to discharge into a sewer-connected, properly-trapped, water-supplied open sink.

Sinks and water-closets are often found in cellars, and, apart from the fact that such fixtures ought never to have been put there, they are hardly ever used, and their seals have evaporated, allowing sewer-gas to enter the cellar through the empty trap. Such disused fixtures should be removed and disconnected.

Traps of fixtures are not yet vented in every house, hence syphonage is rather a common occurrence. The soil- and main waste-pipes are not always extended above the roof, and, when extended, are often fitted with return-bends and cowls. A common defect in tenement-house plumbing is the improper joint-connection of pipes, putty and cement joints being frequent. In some houses the traps are of quite an antiquated form, bottle and other old traps being occasionally found. Holes in traps, in waste-pipes, and in all other pipes, abound, and are either left open or are closed with putty, dough, or rags. The sinks have woodwork enclosing them beneath and around, the spaces within such enclosures being exceedingly foul and filthy; as have also water-closets, which are the most abused fixtures in the house. So many people use, so many more abuse, and so few

clean, them, it is no wonder at all that water-closets are masses of filth and that they poison the air. In some houses the water-closets are situated in cellars. Of the school-sinks I have already spoken. The long Philadelphia hopper closets, those especially with a spiral flush, are a nuisance, as they are never clean, nor well flushed. Pan closets are not so frequent in tenements, thanks to sanitary inspectors, who order them out as soon as they discover them.

There are a great many ways in which plumbing may be defective, as we have seen in Part I., and the only remedy is to be constantly on guard, inspect the plumbing frequently, and have it put in proper condition by licensed plumbers.

Cellars.—The cellar of a tenement-house is an important adjunct, and the location of a great many nuisances, some of which have been already mentioned. Formerly basements and cellars were terms often interchangeable; the law now makes a distinction, however, and defines both as follows:

> "A basement is a story partly but not more than one-half below the level of the curb."
>
> "A cellar is a story more than one-half below the level of the curb."

The other points of the law in regard to cellars are as follows:

> "The floor of the cellar, or lowest floor of every tenement-house, shall be water-tight, and the cellar ceilings shall be plastered. The cellar walls and ceilings shall be thoroughly whitewashed or painted a light color by the owner at least once a year."

Cellars, as a rule, ought not to be occupied for living or sleeping purposes, although a great many of them are. The conditions of living in basements of new houses are defined by the law as follows. [For conditions of living in cellars of old houses see Tenement Law.]

1. Such room shall be at least eight feet high in every part from the floor to the ceiling.

2. The ceiling of such room shall be in every part at least two feet above the surface of the street or ground outside of or adjoining the same.

3. There shall be appurtenant to such room the use of a separate water-closet.

4. There shall be outside of and adjoining such room, and extending along the entire frontage thereof, an open space of at least two feet six inches wide in every part. The bottom of said space shall be at least six inches below the level of the floor of the room, and such space shall be well and effectually drained by a drain the bottom of which shall be at least one foot below the level of the floor of the room.

5. Such room shall have a window or windows opening to the outer air of at least nine feet square in size clear of the sash frame and at least four and one-half square feet of which shall have been made to readily open for purposes of ventilation.

Cellars, in a great many houses, are not cemented at all, and frequently are damp, and, when near shores, are partly or wholly full of water.

The causes of water in cellars are many, and it is sometimes difficult to find the source of the water. The following are the main causes of water in cellars:

1. *Ground-water.* If cellars are not completely disconnected from the ground by concrete, etc., the ground-water, if at a high level, may enter the cellar.

2. *Tide-water.* The tide, when at high pressure, may back up into the cellar through the sewer and drain-pipes.

3. *Spring-water.* Hidden springs may crop out in the cellar.

4. *Surface drainage.* Some surface pond, pool, or collection of rain-water, etc., may be near a cellar, and the water therefrom drain into the cellar.

5. *Leaks in water-service pipes,* either near or within the house.

6. *Leaks in sewer-pipes,* either near or within the house; sometimes from hopper closets or school-sinks in adjoining houses.

The character of the water in cellars must be analyzed, if its source is unknown, to discover whether the liquid comes from the sewer or water-pipes. Defects in sewers and sewer-connected fixtures can also be discovered by putting into the suspected sewers or fixtures some coloring matter, as uranine or fuchsine, and watching for the appearance of the color in the cellar-water.

The remedy for water in the cellar is the removing of the cause and making the cellar water-tight.

Overcrowding.—Apartments or rooms within a house are sometimes, especially at night, occupied by too many people in proportion to the floor and cubic space, hence night inspections are undertaken by the proper authorities to determine the number of occupants, and to measure the space in rooms.

"Sec. 112. No room in any tenement-house shall be so overcrowded that there shall be afforded less than 400 cubic feet of air to each adult, and 200 cubic feet of air to each child under 12 years of age occupying such room; and no apartment in any tenement-house shall be so overcrowded that there shall be afforded in the living rooms and bedrooms of said apartment less than 600 cubic feet of air to each individual."

Condition.—No matter how well constructed the tenement-house may be, if, after construction, the house is not properly taken care of, it will become dilapidated, filthy and offensive. A strict supervision over and care of the yard, fixtures, etc., are essential to the house being fit to live in, and therefore the law not only calls for proper cleaning of the house and its several parts, but also that, in each and every tenement-house, there should reside a housekeeper, whose sole duty it should be to take care of the house, clean all its parts, and exercise supervision over it.

Yards in tenement-houses are usually very small, and are greatly abused. In a space of 10–12 × 25 feet will often be found the yard hoppers or school-sink; and the space is filled by the inevitable clothes-lines. The yard should be properly cemented or flagged, and so graded as to discharge all surface-water into a properly trapped, sewer-connected, drain. The yard should be swept clean, and kept free from rubbish.

The Air-shafts, Courts, and Areas should be properly paved, graded, and drained, and should be kept clean. The fresh-air inlet in the front area, or in front sidewalk, should be kept clear of all obstructions.

The Cellar. Even the best-constructed cellar will become offensive if not properly taken care of. The floor of the cellar should not be broken, as the holes become receptacles for dirt, and the walls and ceiling should be whitewashed or painted frequently. The cellar-floor is to be drained when the house-drain is underground, the drain to be trapped with a syphon trap provided with very deep seal to prevent evaporation.

The cellar should be cleaned of all offensive refuse and rubbish, and be frequently disinfected.

The Halls of tenements are, as a rule, dark and dreary, dimly lighted by day, and little more so by night. The law relating to lights at night in halls is as follows:

> "In every tenement-house a proper light shall be kept burning by the owner in the public hallways, near the stairs, upon the entrance floor, and upon the second floor above the entrance floor of said house, every night from sunset to sunrise throughout the year, and upon all other floors from sunset till 10 P. M."

The rails and balusters of stairs should be secure and in good repair, and the wainscoting and floors of the halls shall be well kept and frequently scrubbed and cleaned. The practice of papering walls of halls is pernicious; a light-colored paint being the best covering over walls and ceilings of halls, as well as of water-closet apartments.

The Water-closet Apartment should be well looked after, as it is the place most likely to be dirty in a tenement-house. The floor should be clean, and must be of an impervious material. The floor, seats, walls, ceilings, windows, etc., should be frequently cleaned.

The Roofs of tenement-houses require great care, and should be clean and free from defects and leaks. Guard-rails should protect the roof on all sides, and the eaves-gutters should be in good repair and tight; the whole roof should be painted once a year. The chimney, pipes, and tank on roof also should be kept in good condition.

The Plumbing Fixtures have often been alluded to already, and nothing remains but to emphasize the fact

that, of all parts of the house, the plumbing and plumbing fixtures must be constantly watched, that all defects may be promptly repaired, and cleanliness exercised to the utmost.

The Rooms should be clean, the walls and ceilings painted, and floors scrubbed; the windows should be easily opened and cleaned, and often left open to change the air in the rooms.

CHAPTER III.

PRIVATE DWELLINGS.

Houses built for one or two families are, as a rule, of better construction than tenement-houses, but there is a large number of old houses which were built years ago, and which are in a bad sanitary condition, that are used as private dwellings.

The points especially to be looked after by the inspector examining private dwellings are the cellar and the plumbing.

The cellar is, as a rule, large and spacious, but is usually filled with rubbish and refuse, and the floor is rarely a cemented one. The antiquated hot-air furnace so often found in the cellars of private houses is a cause of frequent complaint, as it is hardly ever in good order, is badly constructed, the joints not being tight, the flues and air-conduits defective, the cold-air box in the wrong place, and the whole a source of smoke and coal-gas. The servants' closet (usually an old pan closet) is located in the cellar; the house-drain is underground, and either of earthenware or of brick. The cellar, as a whole, is a repository for sewer-air and a breeding-place for disease germs.

The plumbing in old private houses is sometimes so complicated and so full of defects that it is at times a matter of difficulty to examine it. The reason for

this is that these old houses have been subjected to the bungling of several generations of plumbers, each trying to remedy certain evils, but instead adding to them by some new complicated "by-pass," connection, etc. The wash-basins in the many bedrooms may be a convenience, but they are certainly additional means of allowing sewer-air to enter the house. These wash-basins are all over the house, irrespective of the location of the main waste-pipe, and consequently require the running of long, horizontal, lead branch-pipes under the floor, with the likelihood of these being gnawed by rats and broken into by nails. The wash-basins are also left unused for long periods, and the traps consequently lose their water-seal by evaporation, thus permitting the escape of sewer-air from the drain. Vent-pipes are not often found, and syphoning is frequent. Private dwellings are the places where the pan water-closet is still frequently found; nor is the extension of vertical pipes the rule in these old houses.

Altogether the sanitary condition of many old dwellings is deplorable; and as the municipal authorities are mostly occupied looking after tenement-houses, the private dwellings receive little or no attention unless some disease breaks out, or some tenant has the courage to complain to the proper department.

Right here it is proper to remark that unsanitary conditions are found alike in the palace and in the hovel; it is a difference of degree rather than of kind —often the result of ignorance of those primal truths, easy of comprehension,—truths, the application of which it has been our object, in this book, to elucidate.

CHAPTER IV.

LODGING-HOUSES.

"A lodging-house is a house or building, or portion thereof, in which persons are harbored or received, or lodged for hire for a single night, or for less than one week at a time; or any part of which is let for any persons to sleep in for a term less than a week." N. Y. San. Code.

This is the official definition of a lodging-house, and, although applicable also to hotels, is meant for the cheap lodging-houses used by the transient population of cities, and especially of the poorer class. Lodging-houses are under the supervision of the sanitary authorities; and their construction, maintenance, and keeping are under the surveillance of the inspectors of lodging-houses. The N. Y. San. Code insists that

"Beds in all lodging-houses shall be separated by a passageway of not less than 2 feet horizontally, and the beds shall be so arranged that under each of them the air shall freely circulate, and there shall be adequate ventilation. Four hundred cubic feet (400) of space shall be provided and allowed for each bed or lodger."

The following regulations of the Boston Board of Health are quite explicit in regard to lodging-houses (Chapin):

"1) The means of light and ventilation must be satisfactory to the Board of Health, and beyond control of the lodgers.

"2) All floors and stairways must be sound, smooth, and either painted or shellacked.

"3) Air-space 300 (in New York 400) cubic feet.

"4) Open and spacious dormitories are preferred.

"5) Single rooms must have fire-proof partitions.

"6) No carpets allowed on floors or stairs.

"7) No less than 2 horizontal feet between sides of any 2 beds.

"8) Bedsteads must be single and of iron.

"9) Blankets required, comforters prohibited.

"10) Mattresses to be covered with fire-proof covering.

"11) No one is allowed to sleep in his day clothing.

"12) Unclean persons must take a bath before retiring.

"13) Water-closets (one to every 20 lodgers), lavatories, and shower baths, with hot and cold water, all with open plumbing, must be furnished on each floor, and floors to same must be of marble, slate, or concrete."

Lodging-houses are frequently inspected at night. The following extract is from the New York City charter:

DIMENSIONS AND VENTILATION OF ROOMS.

"Sec. 1316. In every such house hereafter erected or converted every habitable room, except rooms in the attic, shall be in every part not less than 8 feet in height from the floor to the ceiling; and every habitable room in the attic of any such building shall be at least 8 feet in height from the floor to the ceiling, throughout not less than one-half the area of such room. Every such room shall have at least one window connecting with the external air, or over the door a ventilator of perfect construction, connecting it with a room or hall which has a connection with the external air, and so arranged as to produce a cross-current of air. The total area of window or windows in every room communicating with the external air shall be at least one-tenth of the superficial area of every such room; and the top of one, at least, of such windows shall not be less than 7 feet 6 inches above the floor, and the upper half at least, shall be made so as to open the full width. Every habitable room of a less area than 100 superficial feet, if it does not communicate directly with the external air, and is without an open fire-place, shall be provided with special means of ventilation, by a separate air-shaft extending to the roof, or otherwise, as the Board of Health may prescribe."

CHAPTER V.

SWEAT-SHOPS.

In large cities, owing to the overcrowding and poverty of the foreign population, a great many industries are being pursued in the homes of the working people, thus adding to the general unhealthy conditions of the houses of the poor the evils peculiar to the various unsanitary industries. Tailoring in its various branches, necktie-making, cigarmaking, and kindred industries have been taken up by the Italians, Hebrews, Hungarians, and other foreigners, and the air of the tenement-house, already overladen with impurities, is further poisoned by dust, dirt, and the unwholesome ingredients of the individual manufactures; often one room serves as working-, sleeping-, cooking-, and living-place. That such conditions are dangerous to health is conceded by all; but these so-called sweat-shops are also dangerous, in view of the fact that they are the means by which various diseases are disseminated and spread broadcast among the people handling and buying these sweat-shop-made goods.

Various laws have from time to time been enacted to confine, limit, and prohibit work in tenement-houses. The cigar-making industry has already been brought

under control, and the condition of cigar-makers greatly improved; the tailoring industry, however, by which tens of thousands of tenement-house dwellers make their living, is as yet not effectually controlled.

The following sections of the New York Labor Law relating to sweat-shops are interesting as covering all points:

"**Manufacturing, altering, repairing, or finishing articles in tenements.**—No room or apartment in any tenement or dwelling-house, or in a building situated in the rear of any tenement or dwelling-house, shall be used for the purpose of manufacturing, altering, repairing, or finishing therein, any coats, vests, knee-pants, trousers, overalls, cloaks, hats, caps, suspenders, jerseys, blouses, dresses, waists, waist-bands, underwear, neckwear, furs, fur trimmings, fur garments, skirts, shirts, purses, feathers, artificial flowers, cigarettes, cigars, or umbrellas, unless a license is secured therefor as provided in this article. But nothing herein contained shall apply to collars, cuffs, shirts or shirt-waists made of cotton or linen fabrics that are subjected to the laundrying process before being offered for sale. If the factory inspector ascertain that such room, apartment, or building is in a clean and proper sanitary condition, and that the articles specified in this section may be manufactured therein under clean and healthful conditions, he shall grant a license permitting the use of such room, apartment, or building, for the purpose of manufacturing, altering, repairing, or finishing such articles. Each license shall state the maximum number of persons who may be employed in the room or rooms to which such license relates. The number of persons to be so employed shall be determined by the number of cubic feet of air-space contained in each room or apartment mentioned in such license, allowing not less than 250 cubic feet for each person employed between the hours of 6 o'clock in the morning and 6 o'clock in the evening; and, unless by a special written permit of the factory inspector, not less than 400 cubic feet for each person employed therein between the hours of 6 o'clock in the evening and 6 o'clock in the morning, but no such permit shall be issued unless such room or apartment is lighted by electricity or other suitable

light, at all times during such hours, while such persons are employed therein. If the factory inspector finds that infectious or contagious diseases exist in a workshop, room, or apartment of a tenement or dwelling-house or of a building in the rear thereof, in which any of the articles specified in Sec. 100 of this chapter, are being manufactured, altered, repaired, or finished, or that articles manufactured or in process of manufacture therein are infected, or that goods used therein are unfit for use, he shall report to the local board of health, and such board shall issue such order as the public health may require. Such board may condemn and destroy all such infected articles or articles manufactured or in the process of manufacture under unclean or unhealthful conditions."

CHAPTER VI.

WORKSHOPS AND FACTORIES.

THE term "factory" is used to designate a place where work is done by one or more persons by means of mechanical power, whereas a "workshop" is a place where work is done by one or more persons without mechanical power; thus, a tailor-shop with machines run by hand or foot is a workshop, but if these machines are run by steam, then it is a factory. This is the logical differentiation and definition of the terms, although the New York Labor Law says: "The term 'factory' shall be construed to include also any mill, workshop, or other manufacturing or business establishments where one or more persons are employed at labor."

A great part of the workingman's life is spent in the workshop or factory, and the sanitary condition of these is of the very greatest importance, as it has a decided influence upon the health and longevity of the laborer. The pursuit of some special trade may be fraught with various dangers to the health and life of the worker; add to these dangers a workroom which is unsanitary, ill ventilated, not properly lighted, badly plumbed, and overcrowded, and the dangers are increased a hundredfold.

To remedy the evils of unsanitary workshops and factories, most of the States have passed laws to improve the condition of the workingman and the places in which he works. These laws are called "factory" or "labor" laws, and their administration is entrusted to a specially created Factory, or Labor Department.

The following is an extract from the provisions of the New York Labor Law of 1897:

"1) Eight hours shall constitute a day's work for all classes of employees in this State except those engaged in farm and domestic service. The wages to be paid for a legal day's work upon all public work shall not be less than the prevailing rate for a day's work in the same trade or occupation in the locality where such work is being done.

"2) Ten consecutive hours' of labor, including one-half hour for meals, shall constitute a day's work in the operation of all street surface and elevated railroads in cities of more than 100,000 inhabitants.

"3) Ten hours, exclusive of the necessary time for meals, shall constitute a legal day's work in the making of bricks in brick-yards.

"4) Every person employing females in a factory shall provide and maintain suitable seats for the use of such female employees.

"5) Scaffolding, hoists, and staging, etc., to be constructed, placed, and operated, as to give proper protection to the life and limb of a person employed. All swinging and stationary scaffolding shall be so constructed as to bear 4 times the maximum weight required to be dependent therefrom or placed thereon, when in use; and not more than 4 men shall be allowed on any swinging scaffold at one time.

"6) Protection of persons employed in buildings in cities.

"7) A child under the age of 14 years shall not be employed in any factory in the State. A child between the ages of 14 and 16 years shall not be employed without a certificate from the Health Department.

"8) No minor under the age of 18 years, and no female shall be employed at labor in any factory before 6 A. M. or after 9 P. M., or

for more than 10 hours in any one day or 60 hours in one week, except to make a shorter work-day on the last day of the week.

"9) Elevators and hoisting shafts to be enclosed and properly cared for and guarded.

"10) Hand-rails to be provided on all stairways. The steps of stairs to be provided with securely-fastened rubber. Stairs to be screened at sides and bottom. Doors to open outwardly and not to be locked, fastened, or bolted during work.

"11) Wherever machinery is used, belt-shifters or other contrivances to be provided for throwing belts on and off pulleys. All vats, pans, saws, etc., to be properly guarded. Exhaust-fans to be provided for the purpose of carrying off dust from emery-wheels, grindstones, and other machinery creating dust.

"12) Fire-escapes to be provided in all factories.

"13) Walls and ceilings of workrooms to be cleaned, white-washed, or painted.

"14) **Size of rooms.**—No more employees shall be required or permitted to work in a room in a factory between the hours of 6 o'clock in the morning and 6 o'clock in the evening than will allow to each of such employees not less than 250 cubic feet of air-space; and, unless by a written permit of the factory inspector, not less than 400 cubic feet for each employee, so employed between the hours of 6 o'clock in the evening and 6 o'clock in the morning, provided such room is lighted by electricity at all times during such hours, while persons are employed therein.

"15) **Ventilation.**—The owner, agent, or lessee of a factory shall provide, in each workroom thereof, proper and sufficient means of ventilation; in case of failure the factory inspector shall order such ventilation to be provided.

"16) **Wash-room and water-closets.**—Every factory shall contain a suitable, convenient, and separate water-closet or water-closets for each sex, which shall be properly screened, ventilated, and kept clean and free from all obscene writing or marking; and also a suitable and convenient wash-room. The water-closets used by women shall have separate approaches. When women or girls are employed, a dressing-room shall be provided for them, when required by the factory inspector."

It will thus be seen by a careful perusal of the above so-called "labor laws" that the workingman has been

the object of favored legislation. What is wanted from now on is not more laws, *but the strict literal interpretation and rigid application of all existing laws.* Then and then only will the condition of the poor unfortunates who are compelled to work amid most unsanitary environments be improved.

CHAPTER VII.

MERCANTILE ESTABLISHMENTS.

By "mercantile establishments" is meant places where goods are sold or held for sale, such as stores, sale shops, department stores, etc. These places were, as a rule, not included in the factory acts, and as the employees in them are mostly women and children, great need was felt for regulating the hours of labor and putting these establishments in a sanitary condition.

The mercantile law in New York State, known as Chapter 418 of the Laws of 1897, is a decided forward step in this direction.

The following are the essential sections of this law:

"1) Sixty hours is the maximum of time in one week that a woman under 21 and male children under 16 shall be made to work.

"2) Children under 12 are not to be employed. Children between 12 and 14 years of age can be employed only during vacation time, but must have a certificate from the Health Department. Children between 14 and 16 can be employed only after receiving a certificate as to their school attendance, strength, etc.

"3) Suitable wash-rooms and water-closets are to be provided. The water-closets are to be separate for males and females, and are to be properly screened and ventilated.

"4) Lunch-rooms are not to be adjacent to water-closets.

"5) Seats, stools, or other suitable seats must be provided for all female employees.

"6) Women and children not to work in basements unless permitted by the Health Department."

CHAPTER VIII.

THE SMOKE NUISANCE.

Among the many nuisances incident to city life is the black smoke belched forth from the chimneys of factories. The composition of the smoke as it leaves the chimney depends upon the character of the fuel burned, as well as on the manner of combustion and the care with which it is carried out. Smoke consists of carbon and various gases; its density depends on the number of particles of unconsumed carbon. When the coal used is entirely consumed, no black smoke forms, but if the combustion is incomplete, a large part of the unconsumed fuel will go off and be wasted in the form of smoke, causing a vitiation of the air.

Anthracite coal and coke give no smoke, or, at least, very little; but if soft coal, and especially if shavings, sawdust, etc., be burned, the smoke will be abundant and black. When furnaces are of sufficient capacity, with grates having a large area, with the coal spread continuously in a thin sheet, and with the requisite amount of air furnished, the production of smoke greatly diminishes.

There are various smoke-consuming and smoke-pre-

venting appliances employed with a view to abating the nuisance.

The following are the recommendations printed in a circular of the Cincinnati engineer in charge of this nuisance (Chapin):

"1) Have a hot fire. Give the gas sufficient space and time to burn before the fire is below a red heat.

"2) Fire in small quantities over one part of the grate at a time. The other parts must be closely watched and promptly attended to.

"3) Keep a clean fire all the time. Never keep a set of bare grate-bars in service that are warped or burned, because the air-spaces become closed. Keep the side walls of furnaces in good repair, ash-pit free from ashes, and bridge-wall clean and in repair. Do not permit deposits to accumulate back of the bridge-wall.

"4) Clean flues or tubes at least once each day.

"5) Do not delay if draught is not good, but attend to it immediately, as a good draught is important in attaining good combustion."

CHAPTER IX.

BAKERIES.

Bakeries are commonly located in cellars, and their proper ventilation, lighting, and plumbing are, as a rule, bad and defective. The small bakeries in the tenement-house districts are usually in bad sanitary condition, and endanger the health of the employees, who are compelled to work in the hot, stifling atmosphere from 12 to 16 hours during the night; moreover, they are a source of danger in spreading infection among consumers of the bakery products. Most cities have some laws in regard to bakeries. In New York State, bakeries are under the supervision of the Health Department of the municipality, as well as under that of the Factory Inspector of the State.

The following is an extract from the New York State Labor Law:

"Sec. 110. **Hours of labor in bakeries and confectionery establishments.**—No employee shall be required or permitted to work in a biscuit, bread, or cake bakery or confectionery establishment more than 60 hours in any one week, or more than 10 hours in any one day, unless for the purpose of making a shorter work day on the last day of the week; nor more hours in any one week than will make an average of 10 hours per day for the number of days during such week in which such employee shall work.

"Sec. 111. **Drainage and plumbing of buildings and rooms oc-**

cupied by bakeries.—All buildings or rooms occupied as biscuit, bread, pie, or cake bakeries, shall be drained and plumbed in a manner conducive to the proper and healthful sanitary condition thereof, and shall be constructed with air-shafts, windows, or ventilating-pipes, sufficient to insure ventilation. The factory inspector may direct the proper drainage, plumbing, and ventilation of such rooms or buildings. No cellar or basement, not now used for a bakery shall hereafter be so occupied or used, unless the proprietor shall comply with the sanitary provisions of this article.

"Sec. 112. **Requirements as to rooms, furniture, utensils, and manufactured products.**—Every room used for the manufacture of flour or meal food-products shall be at least 8 feet in height and shall have, if deemed necessary by the factory inspector, an impermeable floor constructed of cement, or of tiles laid in cement, or an additional flooring of wood properly saturated with linseed oil. The side walls of such rooms shall be plastered or wainscoted. The factory inspector may require the side walls and ceiling to be whitewashed, at least once in three months. He may also require the woodwork of such walls to be painted. The furniture and utensils shall be so arranged as to be readily cleansed and not prevent the proper cleaning of any part of the room. The manufactured flour or meal food-products shall be kept in dry and airy rooms so arranged that the floors, shelves, and all other facilities for storing the same can be properly cleaned. No domestic animals, except cats, shall be allowed to remain in a room used as a biscuit, bread, pie, or cake bakery or any room in such bakery where flour or meal-products are stored.

"Sec. 113. **Wash-room and closets; sleeping places.**—Every such bakery shall be provided with a proper wash-room and water-closet or water-closets apart from the bake-room, or rooms where the manufacture of such food-product is conducted, and no water-closet, earth-closet, privy, or ash-pit shall be within or connected directly with the bake-room of any bakery, hotel, or public restaurant. No person shall sleep in a room occupied as a bake-room."

The following rules are from the Pennsylvania law (Chapin):

"1) All bakeries shall be plumbed and drained in a satisfactory manner as approved by the law; and should also be ventilated by means of air-shafts, windows, or ventilating-pipes.

"2) They must have an impervious floor, constructed of cement or of tiles laid in cement, or of wood of which all the crevices shall be filled in with putty, and the whole surface treated with oil varnish. The inside walls and ceilings shall be plastered, and either be painted with oil paint, three coats, or be lime-washed, or the side walls plastered and wainscoted to the height of 6 feet from the floor, and painted or oiled; when painted, paint shall be renewed at least once every 5 years, and shall be washed with hot water and soap at least once in every 3 months; when lime-washed, the lime-washing shall be renewed at least once in every 3 months. No domestic or pet animal shall be allowed in the room.

"3) The manufactured products shall be kept in perfectly dry and airy rooms.

"4) Every such bakery shall be provided with a proper wash-room and water-closets, apart from the bake-room, and no water-closet, earth-closet, privy, or ash-pit shall be within or communicate directly with the bake-room.

"5) Every sleeping-room for persons employed in every bakery shall be kept separate from the room where flour or meal-products are manufactured or stored, and shall be provided with one or more external glazed windows, each of which shall be at least 9 superficial feet in area, of which 4½ feet shall be made to open for ventilation."

CHAPTER X.

STABLES.

In most cities some regulations are in force limiting the location of stables. Thus, in Boston stables are prohibited within 200 feet from churches. In Chicago, in order to build a stable, it is necessary to get the permission of the owners of the houses within 600 feet from the proposed stable; in New York no stable can be kept on the same lot with a tenement-house, and all stables previously built on such lots are being ordered out.

Horses need from 10,000 to 20,000 cubic feet of air in an hour; but as the air of stables can be changed frequently, it has been estimated that the minimum air-space should be 1200 cubic feet. Each horse should have 120 square feet floor-space, the stalls should be 6 feet wide and 9 feet long, and the stable should be ventilated by windows of proper dimensions in opposite walls, and, if possible, by a louvered open ridge between roof and walls.

The floors of stables should be of some impervious material, like cement, bricks, etc., and the woodwork in stalls should be tight, well laid, and frequently taken up and cleaned.

The draining of stables is done by longitudinal open

drains, the so-called "valley drains," which should be covered and connected with the sewer by a properly trapped, extra heavy iron drain.

The manure is kept loose and removed every day in proper manure-carts, or is pressed into barrels or bales and removed once or oftener a week.

The removal of manure is in some cities regulated as to the time; thus, in Jersey City the removal can be done only between 6 P. M. and 7 A. M.; in Boston manure can be removed only after 12 at night during the summer. The stable should be kept clean and frequently disinfected.

We quote the following from the Sanitary Code of New York:

"Sec. 120. That every owner, lessee, tenant, and occupant of any stall, stable, or apartment in the built-up portions of the City of New York, in which any horse, cattle, or other animal shall be kept, or of any place in which manure, stable refuse, or any liquid discharge of such animals shall collect or accumulate, shall cause such manure, stable refuse, or liquid to be promptly and properly removed therefrom, and shall at all times keep or cause to be kept such stalls, stables, or apartments, and the drains, yards, and appurtenances thereof, in a clean and sanitary condition, so that no offensive odors shall be allowed to escape therefrom. It shall be the duty of every such owner, lessee, tenant or occupant, to cause all manure and stable refuse to be removed daily from such stable or stable premises, unless the same are pressed in bales, barrels, or boxes, as hereinafter provided. It shall not be lawful to remove manure and stable refuse in carts or wagons, or to cart the same within the city limits without a permit from the Board of Health, and such carts and wagons shall be of a construction approved by said Board, and every such cart or wagon must have a permit from the Board in writing, and be used in accordance with the terms of such permit and not otherwise. Manure-carts and wagons shall be loaded within the stable premises and not upon the streets or sidewalk, and shall be removed from such premises in a manner

not in any way offensive or to cause any nuisance. All manure and stable refuse when transported through the streets must be so covered and secured that no part of the same will fall upon the street, and so as to prevent the escape of offensive odors, and the same shall not be unloaded or deposited within the city limits, except upon the conditions of a permit in writing from the Board of Health, and at such docks and places as shall be approved by the Board, and to which a permit in writing for such use shall have previously been granted by said Board. No manure or stable refuse shall be allowed to be thrown upon or fall and remain upon any street or sidewalk, or upon any ground near any stable, and no manure and stable refuse shall be allowed to remain for more than 24 hours in any place within any stable, unless it is pressed in bales, barrels, or boxes. No manure-vault or receptacle shall be built or used on any premises within the built-up portions of the city, nor in any other part of the city, except pursuant to the terms of a permit granted therefor by the Board of Health.

"Every owner, lessee, tenant, or occupant of any stall, stable, or apartment, in the built-up portions of the City of New York, in which any horse, cattle, or other animals shall be kept, and from which the manure and stable refuse is not removed daily as hereinbefore provided, shall cause the same to be pressed in bales, barrels, or boxes, at least once in each day, and so pressed as to reduce the same to not more than one-third of the original bulk. Manure and stable refuse pressed in bales, barrels, or boxes, shall be removed to such docks or places as shall be approved by the Board of Health, and to which a permit in writing for such use shall have previously been granted by said Board, and such bales, barrels, and boxes shall not be opened until delivered at such docks or places."

CHAPTER XI.

SLAUGHTER-HOUSES.

SLAUGHTER-HOUSES in cities are apt to become a serious nuisance; they are, as a rule, kept under strict supervision by sanitary authorities, and their location is limited to certain districts, a careful watch being kept over them to prevent unsanitary conditions.

Slaughter-houses must be well lighted, properly ventilated, drained, plumbed, and cared for.

Following are abstracts from the N. Y. San. Code:

"1) That the keeping and slaughtering of all cattle, and the preparation and keeping of all meat and fish, birds, and fowl, shall be in that manner which is, or is generally reputed or known to be, best adapted to secure and continue their safety and wholesomeness as food.

"2) Certain streets and areas defined where slaughtering can be done with permits from the Department.

"3) The slaughter-houses, yards, and appurtenances, to be thoroughly cleansed and purified, and all offal, blood, fat, garbage, refuse, and unwholesome or offensive matter, to be therefrom removed, at least once in every 24 hours after the use thereof for slaughtering purposes; and all woodwork, save floors or counters, shall be thoroughly painted or whitewashed.

"4) That no building occupied wholly or partly as a slaughter-house shall, without special permit, be occupied for a dwelling or lodging-place.

"5) That every such building should be at all times kept adequately ventilated; that no blood shall be kept therein over night;

that adequate underground connection shall be made from every such building with a public sewer; and the yard shall be cemented and paved so as not to absorb blood, and so as to carry all liquids into sewers." Sec. 81–85.

TYPICAL SLAUGHTER HOUSE.

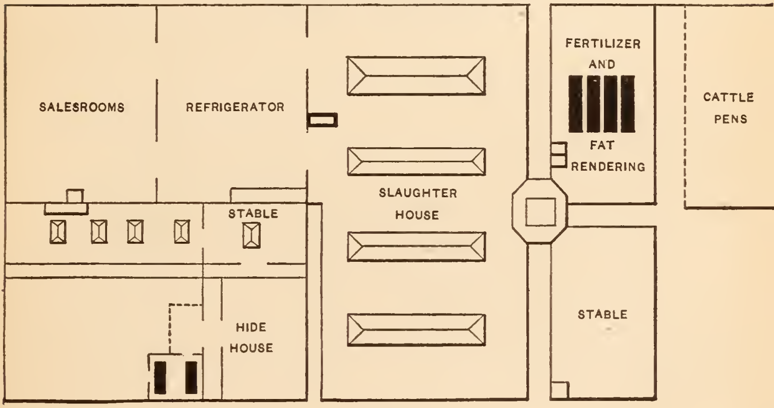


FIG. 29.

(From the New York Health Department Report, 1896.)

CHAPTER XII.

OFFENSIVE TRADES.

There is a large number of trades and manufactures that are for one reason or another offensive, as they produce effects injurious to health and dangerous to life, and thus constitute a public nuisance.

The following classification of offensive trades and processes is taken from Dr. Tracy's encyclopedic article on Public Nuisances in Buck's "Hygiene and Public Health":

1) Offensive trades.
2) Offensive processes.
3) Other nuisances.

Under each heading are classified the nuisances according to their predominant offensive characteristics, *i.e.*, the chief quality on account of which they are looked upon as nuisances.

Offensive Trades.—Those businesses in which the substances dealt with are offensive, or may become so as a result of mechanical manipulation.

Smell.—*a*) Keeping of living animals: horses, cattle, pigs, poultry, etc. *b*) Killing of animals: cattle, sheep, pigs, etc. *c*) Storage or handling of animal mat-

ter: manure, offal, bones, hides, hoofs, horns, fish, oils, eggs, cheese, etc. *d*) Storage or handling of vegetable matter: fruits, vegetables, essential oils, etc. *e*) Storage or handling of mineral matter: oils. *f*) Storage or handling of mixed matter: rags, kitchen refuse.

Dust.—Sand - blast, carpet - cleaning, hair - picking, street-sweeping.

Noise.—Street-vending, junk-dealing, etc.

Offensive Processes.—Those businesses in which the substances dealt with are offensive as a result of *chemical manipulation.*

Smell.—*a*) Manufacture of animal substances: fat-rendering, lard-refining, soap-making, glycerine-refining, gut-cleaning, bone-boiling, pork-packing, tanning, glue-making, shell-burning. *b*) Vegetable substances: brewing, gas-making, distilling, sugar-refining, vinegar-, varnish-making. *c*) Mixed: cooking.

Fumes.—Manufacture of chemicals, glass-works, potteries, bleaching-works, brick-making, smelting, refining, assaying, etc.

Dust.—Plaster-burning, lime-burning, coffee-washing.

Other Nuisances.—Smoke.—Box-factories, planing-mills, foundries, forges, potteries, dye-houses, etc.

Noise.—Railroads, factories, boiler-works, etc.

Most of the enumerated works and trades are offensive for the causes indicated, and are injurious to the health of those who work at those trades and also to others outside of the industry. The modes of preventing the deleterious effects of these industries upon the health of those employed in them, and also of preventing them from becoming public nuisances, cannot be gone into here.

CHAPTER XIII.

FOOD.

The supply of food for the needs of man is not only an economic question, but it is also a sanitary problem, when the food for any reason becomes unfit for use and injurious to health.

The causes of food being unfit for use are several, and may be enumerated thus:

1) An unhealthy or diseased source.

2) An unwholesome or diseased condition.

3) Adulteration of the food.

An unwholesome source and condition: meat from diseased cattle; milk from sick cows; food decayed and unfit by reason of putrefaction, or by reason of being put up in certain containers, such as tin cans, boxes, etc.

Adulteration of foods: adulterations may be divided into those injurious to health and those not so. The prevalent processes of adulteration are the following:

1) By eliminating some important ingredient, such as removing the cream from milk, *i.e.*, skimming.

2) By substituting some cheaper material for the one more expensive, such as oleomargarine for butter, etc.

3) By the addition of some seemingly harmless substance, such as water to milk.

4) By the addition of some preservative, such as borax, salicylic acid, formaldehyde, etc.

5) By coloring an inferior grade to make it appear as a superior one.

6) By the addition of spices or other ingredients to improve the taste, etc.

All adulteration of food is prohibited or regulated, and the sale of decayed, unwholesome, and unfit foods is prohibited. The laws about food are not only Municipal and State, but also Federal; thus, the meat industry is partly under the supervision of the Federal Government.

CHAPTER XIV.

MEAT.

MEAT is a staple and a most important article of food; it is under complete sanitary supervision from the time the cattle are raised and brought to the markets, to the time it is exposed for sale in the retail shops.

The supervision of the cattle-raising trade, and the slaughtering in the abattoirs is under the Federal as well as State control. There are laws regulating the sale of cattle, their keeping, transportation, the methods of killing, the places of killing, etc.

The characteristics of good meat are, according to H. Sydney Marsden, F.R.S. (*San. Record*, July), the following:

"Mutton and beef, when of good quality, possess a rich, bright, uniform color, neither too pink nor of a too deep purple tint; and a firm texture, free from flabbiness, though moderately soft and elastic. It has a marble appearance, due to the deposits of fat among the connective tissue between the muscles. It should not be wet or clammy, nor should the fat look like jelly or parchment, as these are signs that the meat is unwholesome and unfit for use. It should scarcely moisten the fingers, and the juice should be distinctly acid. It should have little or no odor.

"The characteristics of fresh fish are the following: The skin should be bright and clean and retaining its scales, the flesh firm

and not flaccid, soft, or broken down, and the gills should be pink, bright, and clean-looking, and not of a dirty brown color; the condition of the lining membrane of the body cavity should be carefully examined and be in a healthy, sound condition, and the smell not disagreeable."

The following sections of the New York Sanitary Code in relation to foods, meats, etc., cover most points in the sanitary supervision of foods.

"Sec. 44. That no meat, fish, birds, or fowl, fruit or vegetables, nor any milk, not being then healthy, fresh, sound, wholesome, and safe for human food, nor any meat or fish that died by disease or accident, shall be brought within said city, or offered or held for sale in any public or private market, as such food, anywhere in said city.

"Sec. 45. That no calf, pig, or lamb, or the meat thereof, shall be brought, held, or offered for sale, as such food, in said city, which (being a calf), when killed and dressed, weighs less than forty-five (45) pounds; or (being a pig) was, when killed, not more than five weeks old; or (being a lamb) was, when killed, not more than eight weeks old. Nor shall any meagre, sickly, or unwholesome fish, birds, or fowl, be brought, held, sold, or offered for sale, as such food, in said city.

"Sec. 46. That no cattle shall be killed for human food while in an overheated, feverish, or diseased condition; and all such diseased cattle, in the City of New York, and the place where found, and their disease, shall be at once reported to this Department by the owner or custodian thereof, that the proper order may be made relative thereto, or for the removal thereof from said city.

"Sec. 47. That no meat or dead animal above the size of a rabbit shall be taken to any public or private market for food until the same shall have fully cooled after killing, nor until the entrails, heads, and feet (except of poultry and game, and except the heads and feet of swine) shall have been removed; nor shall the body or any part thereof of any animal which is to be used as food be carted or carried through the streets, except it be covered so as to protect it from dust and dirt; and no meat, poultry, or game shall be hung or exposed for sale outside of any shop or store in this city or in the open windows and doorways thereof.

"Sec. 48. That no decayed or unwholesome fruit or vegetables, no impure or unhealthy or unwholesome meat, fish, birds, or fowl, shall be brought into said city, to be consumed or offered for sale for human food, nor shall any such articles be kept or stored therein.

"Sec. 50. That no cased, blown, plaited, raised, stuffed, putrid, impure, or unhealthy or unwholesome meat or fish, birds, or fowl, shall be held, bought or sold, or offered for sale, for human food, or held or kept in any market, public or private, or any public place in said city.

"Sec. 51. That no meat, fish, fruit, vegetables, or milk, or unwholesome liquid, shall knowingly be bought, sold, held, offered for sale, labelled, or any representation made in respect thereof, under a false name or quality, or as being what the same is not, as respects wholesomeness, soundness, or safety for food or drink."

Horse-meat is often sold in large cities, and represented by butchers as that of cattle. In New York City the Board of Health strictly enforces Sec. 84 of the Sanitary Code, which reads as follows:

". . . And the slaughtering of horses for food is prohibited, and no horses shall be slaughtered in the City of New York without a permit, in writing, from the Department of Health; and no meat of slaughtered horses shall be brought into, or held, kept, or offered for sale, at any place in said city."

The following is an extract from an article by Dr. M. Betz in the July *Public Health Record*. It is of interest as to the identification of horse-meat:

"In bulk, horse-meat is detected comparatively without difficulty; the meat itself is remarkable on account of a peculiar dark purple-brown, with age, especially if it is exposed to the air, sometimes even changing to a black-purple. The interstitial fibres are very fine, much more elastic than in beef; a horse-steak, therefore, seems quite soft. The muscular layers part easily, and the meat on that account seems softer notwithstanding the coarse grain. The odor is peculiar, unpleasantly sweet. The taste of raw horse-meat is so decidedly sweet that even an unsuspecting person would

at once remark this peculiarity. This sweetness is caused by a large percentage of a peculiar sugar called glycogen, which is present in horse-meat in very much larger proportion than in the meat of any other animal used for food, and it is upon this sugar that the chemical identification of horse-meat depends.

"The fat of horses is soft and oily, from a light to a dark yellow color. The poorer the horse, the more yellow the fat. This fat, when a quarter of horse-meat is hung out in the open air, on account of its soft character, will, by its own specific gravity, form small bag-like forms, and thus gives a quarter of horse-meat a quite peculiar appearance."

CHAPTER XV.

MILK AND MILK-INSPECTION.

MILK consists of 87.17% water and 12.83% solids. The solids consist of 3.69% fats, 4.88% carbohydrates, and 6.71% salts.

Milk should be opaque, of full, white color, and without peculiar taste or smell; on boiling it should not change in appearance. Its reaction is slightly acid or neutral. Specific gravity, 1.025% to 1.035%; cream 10% or more. The best preservative for milk is boiling. Various chemicals are sometimes added to preserve milk, some of which are harmless, others harmful. Among the principal substances added to secure the preservation of milk are the following: sodium carbonate, borax, boric acid, formaldehyde, etc.

Milk is adulterated by the subtraction of its cream, *i.e.*, "skimming"; by the addition of water, and by the addition of preservatives or other foreign materials, such as starch, dextrine, chalk, etc.

The following circular of the New York Department of Health gives a detailed and thorough description of the rules and regulations for the sale, care, and examination of milk:

RULES AND REGULATIONS OF THE HEALTH DEPARTMENT OF THE CITY OF NEW YORK FOR THE SALE AND CARE OF MILK. FEBRUARY, 1896.

Extract from Sanitary Code of Laws Governing the Sale of Milk.

"Sec. 186. No milk which has been watered, adulterated, reduced, or changed in any respect by the addition of water or other substance, or by the removal of cream, shall be brought into, held, kept, or offered for sale, at any place in the City of New York; nor shall any one keep, have, or offer for sale, in the said city, any such milk.

"The term 'adulterated' when so used in this section means:

"First—Milk containing more than 88% of water or fluids.

"Second—Milk containing less than 12% of milk solids.

"Third—Milk containing less than 3% of fats.

"Fourth—Milk drawn from animals within 15 days before or 5 days after parturition.

"Fifth—Milk drawn from animals fed on distillery waste, or any substance in a state of fermentation or putrefaction, or on any unhealthy food.

"Sixth—Milk drawn from cows kept in a crowded or unhealthy condition.

"Seventh—Milk from which any part of the cream has been removed.

"Eighth—Milk which has been adulterated with water or any other fluid, or to which has been added, or into which has been introduced any foreign substance whatever.

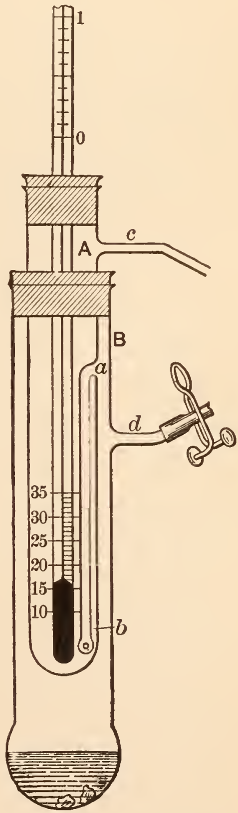


Fig. 30.—Lactometer.

"Sec. 207. Any milk found to be adulterated, either by the addition of water or other substance, or by the removal of cream, or which has been brought into, or is held, or offered for sale, in the City

of New York, contrary to the provisions of Sec. 186 of the Sanitary Code, may be seized and destroyed by any inspector or other officer of this Department authorized to inspect milk.

"Sec. 221. No milk shall be received, held, kept, offered for sale, or delivered in the City of New York, without a permit, in writing, from the Board of Health, and subject to the conditions thereof.

REGULATIONS.

"1. Milk shall not be kept for sale or stored in any room used for sleeping or domestic purposes opening into the same.

"2. Milk must not be transferred from cans to bottles or other vessels on streets or on ferries or at depots, except when transferred to vessel of purchaser at time of delivery.

"3. Milk shall not be sold in bottles except under the following rules:

"Bottles must be washed clean with hot water solution of soap, or soda, or some other alkali, and then with hot water before filling with milk.

"Bottles must not be filled except at the dairy or creamery, and in the city only in rooms so situated as to prevent the contamination of the milk by dust from the streets, or other impurities.

"Bottles must not be washed or filled with milk in any room used for sleeping or domestic purposes, or opening into the same.

"4. The vessel in which milk is kept for sale must be so protected by means of a suitable cover or covered receptacle, and so placed in the store as to prevent dust from the street or other impurities falling into it.

"5. Store permits must be posted in stores so that they can be easily seen at all times.

"6. Wagon permits to be carried on the wagons at all times when engaged in the sale, transportation, or delivery of milk.

"7. The number of wagon and the number of permit, the latter to be preceded by the words 'Health Department Permit,' must be painted on both sides of the wagon in letters two (2) inches in length and one-half (½) inch in width, and in some contrasting color to that of wagon.

"8. If any changes are made in the information given on application blank, the Department must be immediately notified.

RULES FOR HANDLING AND KEEPING MILK.

"1. Milk should be kept in some place where dust and other impurities cannot fall into it, such as a box with tight-fitting cover; preferably an ice-box.

"2. The milk should be kept at as low a temperature as possible, not above 50° Fahrenheit.

"3. After the day's sales are over, the measures and utensils used in the sale of milk should be thoroughly cleaned with boiling water, to which a small amount of soda has been added in the proportion of one tablespoonful of washing soda to a gallon of water.

"4. The overflow pipe from the ice-box in which the milk is kept must not be connected directly with the drain-pipe or sewer, but must discharge into an open, water-supplied, properly-trapped, sewer-connected sink (see Sec. 217 of the Sanitary Code).

"5. The ice-box in which the milk is kept should be cleaned, by scrubbing out with hot soda solution, made as in No. 3, at least twice a week.

"6. In selling milk, stir up the contents of the can thoroughly before measuring out the amount desired. This will prevent unintentional skimming. In this way the last quart of milk sold from the can will contain as much cream as the first quart sold.

"7. It sometimes happens that in cold weather the milk may be delivered to the dealer more or less frozen. If such is the case, detach the ice from the side of the can and gently heat the contents until the ice is all melted. If there is much ice in the can it is absolutely necessary to do this before selling the milk, otherwise the liquid part dipped out and sold at first will contain more of the solid part of the milk and cream, while the ice remaining and consisting principally of water will, after a time, melt, and the result will be milk containing more water than pure milk, and this might be enough to appear as though the milk had been adulterated with water.

"8. Do not place ice in the milk if it is desired to cool it or keep it cold, as the ice will melt, and you will then have adulterated the milk with water.

SUGGESTIONS FOR TESTING MILK. (BY THE CREAM-GAUGE.)

"Fill the cream-gauge one-half full with water, at a temperature of 120° Fahrenheit, to which has been added a few drops of a strong solution of washing soda. Then, after stirring up the con-

tents of the can thoroughly, fill the gauge to the top mark with the milk. Shake well and place in very cold water (say 40° Fahrenheit). In about 30 minutes the cream will have risen and the percentage can be read off, remembering that the result observed must be multiplied by 2, as one-half (½) water and one-half (½) milk was used. Example: 8% of cream was observed by this test; multiplying this by 2 would be 16%, which would be the true amount of cream contained in the milk by this test. Good milk should show by this test 14 to 18% of cream.

"To test for water, the lactometer can be used as follows: Stir the milk to be tested so that a fair sample can be taken. Warm or cool enough milk to 60° Fahrenheit to fill the testing cylinder. Insert the lactometer in the milk in the testing cylinder, being careful not to wet that part of the stem above the milk, and observe where it floats. Pure milk will not fall below the 100° mark on the lactometer at 60° temperature. It must be remembered that skimming the milk will make the lactometer float higher, and the addition of water or cream may make it sink lower than 100°, but if the appearance of the milk upon the lactometer is noted, no one can mistake watered milk for milk to which cream has been added, nor pure milk for milk from which the cream has been removed, as in skimmed milk. In other words, if the lactometer floats below 100° and the milk looks thin, water has been added. If it floats above 100° and the milk looks thin, it may be skimmed, or skimmed and watered. But if it floats above 100° and looks creamy and yellow and sticks to the glass, you can be reasonably sure that it is pure. Good average milk will indicate about 109° on the lactometer at a temperature of 60° Fahrenheit, and show about 14% of cream by the cream test given above."

CHAPTER XVI.

INFECTIOUS DISEASES.

Infectious diseases are those which are due to some external morbific agents of a microbic nature, *i.e.*, microscopic organisms, which multiply and produce certain symptoms and pathological changes peculiar to each variety of organism.

The infectious diseases are divided into:

1) Miasmatic Diseases. Those which are due to some morbific agent outside the body; these diseases are not communicable from one individual to another.

2) Contagious Diseases. The morbific agents of these are produced within the body; these diseases are communicable from one to another, either directly by contact with the sick person, or indirectly on handling the excretion of the diseased person, or objects with which those excretions have been infected.

The secretions and excretions of the body, which are carriers of infection, vary as to the disease, and are the following:

1) Products of respiration; 2) feces and urine; 3) epithelia of the skin or mucous membranes; 4) sweat, milk, blood, and sputum.

The mode of infection is as follows:

1) By direct contact of the healthy person with the diseased one.

2) By indirect contact with the secretions from the diseased person.

3) By clothing, vessels, bedding, and rooms.

4) By insects, flies, mosquitoes, bugs, etc.

5) By food, water, milk, meat, etc.

6) By air and dust—the dried particles from infected secretions floating in the air and producing disease through inspiration.

The following diseases are regarded as infectious and communicable from one individual to another: Small-pox, Cholera, Scarlet Fever, Diphtheria, Croup, Yellow Fever, Typhus, Typhoid, Measles, Whooping-cough, Tuberculosis, Cerebro-spinal Meningitis, Chicken-pox, Leprosy, Erysipelas, Septicæmia, Relapsing Fever, Gonorrhœa, and Syphilis; also the diseases which are communicated from animals to men, viz., Anthrax, Rabies, etc.

To prevent the infection of healthy persons by the diseases enumerated above, communities have adopted various measures. These measures are the following:

1) *Compulsory reporting of infectious diseases.* (*a*) by the physicians treating them; (*b*) by physicians hearing of them; (*c*) and by owners of houses, lodging-houses, boarding-houses, ships, vessels, etc.

2) *Isolation* of patients from healthy individuals, either by certain compulsory measures in the *homes* of the patients, or in *hospitals*.

3) *Quarantine* of the infected person during the period of communicability of the disease.

4) *Disinfection* of the individual, his excretions, the objects he comes in contact with, clothing, rooms, etc.

Not all diseases regarded as infectious are required to be reported. Some diseases which must be reported in one city are not required to be reported in another. Thus, venereal diseases, which are undoubtedly communicable, and at certain times even contagious, are not required to be reported for obvious reasons. Again, in some cities, certain special diseases are not reported. For instance, typhoid fever is not reported in the District of Columbia, Dayton, Jersey City, Memphis, Omaha, St. Paul, Terre Haute, and Toledo. Tuberculosis need not be reported in quite a number of cities. In Hartford, pneumonia is required to be reported. (Chapin, Mun. San. in U. S.)

As to isolation, quarantine, and similar methods for preventing the spread of infectious diseases, the following sections of the N. Y. San. Code cover most points:

"That the phrase 'contagious disease' shall be held to include all persons sick, affected, or attacked by or of a disease of an infectious, contagious, or pestilential nature (more especially, however, referring to cholera, yellow fever, smallpox, chicken-pox, diphtheria [including membranous croup], ship or typhus, typhoid, spotted, relapsing and scarlet fevers, and measles, and also including any new disease of an infectious, contagious, or pestilential nature), and also any other disease publicly declared by this Board dangerous to the public health."

"Sec. 145. That every physician shall report to the Sanitary Bureau, in writing, every person having a contagious disease (and the state of his or her disease, and his or her place of dwelling and name, if known), which such physician has prescribed for or attended for the first time since having such a contagious disease,

during any part of the preceding 24 hours; . . . every attending or practising physician thereat must, at his peril, see that such report is or has been made by some attending physician.

"Sec. 146. That it shall be the duty of each and every practising physician in the City of New York to report, in writing, to the Board of Health, the death of any of his patients who shall have died in said city of contagious or infectious disease, within 24 hours thereafter, and to state in such report the specific name and type of such disease.

"Sec. 147. That every keeper of any boarding-house or lodging-house, and every inn-keeper and hotel-keeper, shall, within 24 hours, report in writing to the Sanitary Bureau the same particulars in the last section required of any physician, concerning any person being at any of the aforesaid houses or hotels, and attacked with any contagious disease."

"Sec. 149. That it shall be the duty of every person knowing of any individual in said city sick of any contagious disease, and the duty of every physician hearing of any such sick person, who he shall have reason to think requires the attention of this Department, to at once report the facts to the Sanitary Bureau in regard to the disease, condition, and dwelling-place, or condition of such sick person.

"Sec. 150. That the keepers, lessees, tenants, and owners of every boarding-house and lodging-house shall, within six hours after the fact shall come to his or her or their knowledge, notify the Sanitary Bureau, in writing, of the fact of any seafaring man or person lately from any vessel being taken sick at such house, and shall in such notice state where such sick person may be found, and from what vessel, and when he came, to the best of the knowledge of the person or persons giving such notice."

"Sec. 153. That pulmonary tuberculosis is hereby declared to be an infectious and communicable disease, dangerous to the public health. It shall be the duty of every physician in this city to report to the Sanitary Bureau, in writing, the name, age, sex, occupation, and address of every person having such disease who has been attended by or who has come under the observation of such physician for the first time, within one week of such time. It shall also be the duty of the commissioners or managers, or the principal, superintendent, or physician of each and every public or private institution or dispensary in this city to report to the Sanitary

Bureau, in writing, or to cause such report to be made by some proper and competent person, the name, age, sex, occupation, and last address of every person afflicted with this disease who is in their care, or who has come under their observation within one week of such time. It shall be the duty of every person sick with this disease and of every person in attendance upon any one sick with this disease, and of the authorities of public and private institutions or dispensaries, to observe and enforce all the sanitary rules and regulations of the Board of Health for preventing the spread of pulmonary tuberculosis."

INCUBATION PERIOD, DURATION AND SOURCE OF INFECTIOUS DISEASE.

Disease.	Incubation Period.	Duration of Disease. Infectiveness.	Sources of Infection.
Diphtheria.....	2-7 days	2-4 weeks. As long as the bacilli are found	Secretions from throat, also objects which come in contact with them.
Rubeola (German measles)	9-21 days	2 weeks	Skin secretions and epithelia.
Measles........	7-14 days	2 weeks. Before and during rash	"
Scarlet fever...	1-7 days	4-8 weeks. As long as skin is peeling	"
Smallpox.......	10-14 days	2-4 weeks. As long as skin is not clear	"
Typhus fever..	10-18 days	2-4 weeks	
Typhoid fever.	14-21 days	3-4 weeks. As long as typhoid bacilli are present in dejecta	Excretions from the bowels.
Whooping-cough	7-14 days	4-12 weeks. As long as spasmodic cough lasts	Sputum and bronchial secretions.
Varicella.... ..	10-14 days	2-3 weeks	Skin.

CHAPTER XVII.

DISINFECTION AND DISINFECTANTS.

We have seen, in the preceding chapter, that one of the modes by which infectious diseases are combated is the disinfection of the diseased person, his excretions, and all objects with which he comes in contact, either directly or indirectly. By *disinfection* is meant the destruction of the morbific agents causing the disease. A *disinfectant* must, therefore, be powerful enough to kill the germs and spores found in the infected substances.

A *deodorant* is not a disinfectant, but is for destroying the bad odors caused by diseased persons or putrefactive changes. It does not, however, kill the germs causing the odors.

Disinfectants are physical and chemical.

Physical disinfectants are light, air, water, and extreme cold or heat—dry or moist. Extreme cold kills many germs, though not all. Extreme heat kills all germs; light kills some. Air and water are not direct germicides, although they are a great help by diluting the sources of infection. The chemical disinfectants are numerous and varied. The principal chemical substances used for the purpose of disinfection are the fol-

lowing: Carbolic Acid, Chlorine, Bromine, Iodine, Corrosive Sublimate, Potassium Permanganate, Sulphur, Sulphurous Acid, Formalin (Formaldehyde), Copper Sulphate, Lime, Etc.

Sulphurous acid, formaldehyde, carbolic acid, and bromine are the principal disinfectants used wherever heat in some of its forms is not used.

The circular of the Department of Health of New York City on "Disinfection and Disinfectants," in Part IV., gives the routine of disinfection as practised in that city.

CHAPTER XVIII.

SCHOOL INSPECTION.

The proper construction and the sanitary condition of schools are of the utmost importance to the community, and the supervision of these matters is entrusted to proper officials, usually in connection with the various educational boards, thus taking schools out of the jurisdiction of sanitary officers. But the numerous private schools existing in almost every town must be, and are, under the supervision of sanitary officers, and should be thoroughly looked after. These schools are apt to be in bad sanitary condition, as it is seldom that their heads are guided by any sanitary considerations in the selection of the places rented for school purposes. This is especially the case with the numerous private schools of the immigrants and foreigners which abound in large cities, and the sanitary condition of which is very deplorable. In New York City no private school is allowed in a tenement-house, and no school is allowed to exist without a permit from the Health Department, whose Inspector of Schools looks after its sanitary condition.

Another sanitary work in connection with schools is the inspection of children, to discover and isolate cases

of infectious diseases. It is a well-known fact that schools are the principal places whence infectious diseases are widely spread; and, in order to prevent this, school inspectors are employed to examine the children every day and prevent the attendance of children exhibiting symptoms of contagious diseases.

For particulars as to school inspection, etc., see the Report on School Inspection in Part IV.

PART THIRD.

SANITARY INSPECTION.

CHAPTER I.

SANITATION AS A PROFESSION.

Fifty years ago there was no such profession as Sanitation. There were a number of persons interested in public-health questions and sanitary problems, but these were the philanthropists and public-spirited men, the pioneers of sanitary reform who strove to better the condition of their fellow men; to lower the death-rate of the community, and to inculcate into the minds of the people the wise saying of Franklin, that "Public health is public wealth."

Thanks to the unselfish devotion and strenuous efforts of those pioneers, great strides were made in the sanitary progress of the nation; vast reforms were undertaken and accomplished; the health of communities was improved; the death-rates of city populations cut in half, and permanent sanitary organizations founded by the establishment of various boards of health in villages, towns, and cities.

The organization of the various sanitary authorities in so many places necessitated the employment of a number of sanitary officers; this number has steadily increased until at present there are several thousand men in the United States engaged in the various departments connected with sanitary work.

At first, when the sanitary work was unorganized and crude, the men engaged in the pursuance of the various investigations were mostly volunteers, principally medical men.

The incomparable, painstaking, thoroughly scientific reports left by some of these volunteers are monuments to their efficiency; *vide* the Report of the Quarantine Convention of 1859, the Report on the Sanitary Condition of New York of the Council of Hygiene in 1866, and others.

With the enlargement and widening of the sanitary field, however, volunteer work became inadequate, and a number of men, mostly physicians, were appointed to continue the work so well begun by the volunteers.

With time and progress the sanitary field has become differentiated and specialized, until, at present, we have the various branches of sanitary work, each with its special inspectors; such as Health, Factory, Sanitary, Building, Plumbing, Offensive-trades, Contagious-disease, Meat, Milk, Fruit, Tenement-house, etc., Inspectors, all embraced in the great and noble profession of Sanitation.

But as the medicine of to-day differs from the medicine of the middle of the last century, and as the educational standard of the physician of the twentieth century

is above that of the nineteenth century, so is the sanitation of to-day different from that of 50 years ago; and the educational standard of the sanitary inspector of to-day is different (or it ought to be) from the standard of the sanitary officers of years ago.

Unfortunately, the sanitary profession of to-day is not as yet what it ought to be, not being filled with the best elements of the medical and engineering professions which are the proper professions for sanitary work. The reasons for this shortcoming are the following:

1) Political selection of sanitary employees.

2) Inadequate compensation.

3) Insufficient education.

4) Absence of organization among the sanitary employees.

Let us examine these causes more thoroughly.

Political Selection of Sanitary Officers.—Dr. Chas. V. Chapin, in his book on "Municipal Sanitation in the United States," says: "Unfortunately most appointees to official sanitary positions in the United States are entirely untrained for the duties they are to perform. To exhibit some degree of natural ability is all that is asked, and often this is not required, the sole qualification of the appointee being his political service to the party which has the appointing power . . . the successful candidate needs no other recommendation than that of 'influential friends.'"

Dr. Wende, of Buffalo, also deplores the political selection of sanitary officers. (*Chicago Medical Record*, April, 1901.)

Of course, while conditions remain as they are; while

the sanitary inspector is in danger of losing his place by the frequent political party upheavals; while the tenure of office is insecure; and while the fitness of the candidate is political instead of scientific, educated, intelligent, and trained men will neither seek nor get sanitary positions.

However, there is already noticeable in many cities a tendency toward reform in this direction; and thanks to the various civil-service laws, as well as to public opinion, there are less changes made in health and sanitary departments than before, and sanitary officers are left undisturbed when their fitness for their work has been proven. There is, therefore, a tendency to establish a permanent tenure of office during good behavior, and the position of the sanitary inspector begins to be more and more secure.

A permanent tenure of office should imply a pension for length of service and disability; and in some places, notably so in New York City, quite a liberal pension provision is, in fact, embodied in the Charter of 1901.

Let us hope, too, that the time is not distant when the following desideratum of Dr. Wende in the article quoted will be fulfilled, viz.: "Selection of municipal health officers for fitness, with secure tenure of office and proper compensation. The municipalities should not be exposed to unnecessary risks by politics." This brings us to the next question of

Proper Compensation.—The work of the sanitary officer is manifold, arduous, difficult, and fraught with many dangers to health and life. If there are any sinecures in the public employment, they are not in the

health and sanitary departments. There is no class of municipal employees whose work is so constant, exacting, difficult, irregular, dangerous, and important, as is that of the sanitary inspectors. The sanitary officer has no 8-hour work-day, with a Saturday half-holiday; he is *always* on duty. Day and night he must be at his post, and when going to bed he is not sure that he will not be called out for some special sanitary work.

He is responsible for the condition of his district; any citizen may come up and find fault with his work; the chronic kicker who finds fault with some intangible nuisance demands that his theories be accepted by the inspector; the "one of the tenants," who is afraid to sign his name to the complaint, threatens to go to the Mayor if his complaint is not attended to at once. Apart from all these, the inspector in the performance of his duties directly endangers his health and life, for he has to climb rickety stairways, go down in cellars full of water and mud, inhale the noxious fumes of open drains and sewers, and come in contact with diphtheria, scarlet fever, typhoid, and other infectious diseases from which the ordinary citizen flees in horror.

If we add to the above the fact that a sanitary officer must possess certain intellectual and educational qualifications, as will be seen later, we should at least expect to find the compensation of the officer adequate to recompense him for his arduous and dangerous work. But on the contrary we find the facts are that so far from his receiving a high salary, he, on the contrary, gets a smaller salary than untrained and unedu-

cated officers in other departments of the municipality. In New York City a janitor of a public school, a messenger in some department, or some other such employee, receives more than the physician or engineer employed in the Health Department.

According to Dr. Chapin, the salaries of sanitary inspectors in the United States range from $600 per annum in Rochester, Cincinnati, Charleston, and Hartford, to $1200 in New York. The average salary in smaller cities is $900, and in larger $1000.

Now, there is no doubt that these salaries are inadequate for the work performed, and for the qualified men who are required for sanitary positions. Most sanitary positions are filled by civil and sanitary engineers and physicians, and it is evident that such men cannot be satisfied with the above salaries. Add to this also the fact that in no position are advancement and increase of salary less to be expected than in municipal positions. When a man works for a private corporation he expects a rise in position and influence proportionate to the years of employment, and the employer need ask no one for permission to raise the salary of a trusted employee. In municipal positions it is difficult to secure an advancement; and every increase of salary raises such a howl from the organs of the party not in power that the heads of departments prefer to let efficient sanitary workers of many years remain at a miserable salary rather than risk harsh criticism from unfriendly organs.

In my opinion, inspectors in large cities should begin with a salary of $1000 or $1200 per annum and each

year should be raised by a certain sum, say $50-60, so that after 15 or 20 years the salary of the sanitary inspector will reach an amount in proportion to his value and experience.

Inadequate Education.—In England the public-health laws require that a sanitary inspector shall have a certificate from one of the several sanitary institutes giving diplomas in sanitation, after a course of study and thorough examination. Here in the United States we have no such special institutes, and no educational requirement is made of the candidate except a civil-service examination, which is, at best, insufficient to show the qualification of the candidate. It is true, some medical and other colleges have lately established courses in sanitary science, but the teaching is as yet very rudimentary, and the students are not those who usually seek sanitary positions.

Absence of Organization and Esprit de Corps among Sanitary Officers.—In England there are several powerful sanitary organizations, such as the Sanitary Inspectors, the Health Officers' Association, the National Health Workers, etc., and almost every sanitary officer of every hamlet, village, or city, belongs to one or other of these organizations. There are also quite a number of very able and influential sanitary monthly and weekly papers devoted solely to sanitation, and read by inspectors. We have nothing of the kind in the United States. There are only one or two monthly journals, hardly ever read by sanitary officers, and there is no organization whatever among the sev-

eral thousand employees of the various health departments throughout the States.*

The evils enumerated and discussed in detail must be eradicated before sanitation, as a profession, will attain a higher place and receive the recognition to which it is entitled.

The objects sought should be:

The selection of sanitary officers for fitness only, after passing a certain educational test; a permanent tenure of office; a substantial salary at the beginning, increasing every year, with a pension after 20 years; also, a thorough organization of all workers in sanitation, with news organs and proper sanitary publications of their own; meetings, conventions, etc.

* The recently organized "Sanitary and Hygienic Society of New York," the membership of which consists of the sanitary officers of the various boroughs; also the "Vermont School for Health Officers" are the first steps towards organization among sanitary employees, to be followed, it is to be hoped, by organization in other cities. The New York Society has a very able organ in its "Public Health Record."

CHAPTER II.

QUALIFICATIONS FOR AND ART OF INSPECTION.

Qualifications.—He who intends to devote himself to the profession of sanitation must be possessed of certain qualifications. In the first place, he should be blessed with a robust, strong constitution, and perfect health, otherwise he will not be able to stand the wear and tear incident to the profession. He should have perfect eyesight, hearing, and sense of smell. He should have at least a high-school education; should know something of geology, physics, chemistry, mathematics, mechanics, physiology, and the allied sciences, and should be able to draw. He should have made a thorough study of sanitation, both theoretical and practical; should understand thoroughly the principles of ventilation, drainage, plumbing, etc., besides knowing enough of practical building construction, etc., that he may not be hoodwinked by builders or plumbers. The inspector should also be fully conversant with all the State and local laws concerning his specialty, and possess the intelligence to pursue the investigations which from time to time may be entrusted to him. The inspector should, of course, have that command of the language which will enable him to make a creditable re-

port to his superiors. He should be sober, industrious, observant, vigilant, conscientious, honest, and thoroughtly imbued with the noble spirit of his profession. He should always bear in mind that he is the physician of the community; that the health and life of the people entrusted to his care depend upon the good work he is doing in his field, and that every effort of his to abate a public nuisance lowers the death-rate in his district and conduces to the health of his fellow men.

The Art of Inspection.—Sanitary inspection means the application of the teachings of the science of sanitation to practice, and as such, inspection becomes an art in which skill and experience count highly. Any one can inspect a house, and anybody may examine a public nuisance, but not every one can find all the defects in the house, or discover the cause of the nuisance; to do this it requires not only theoretical knowledge, but skill and experience as well. The physician just from college may know more of anatomy, etc., than the old practitioner; but who will not pity the poor unfortunate who entrusts the diagnosis of his malady to the youngster just from the college benches. So it is with the sanitary inspector. The probationer may and should know much regarding the theory of sanitation, but he will make the mistake of his life if he thinks he knows it all; and he may find himself rather humiliated when he fails to find defects which an ignorant plumber is able to point out to him in a moment. In sanitation, as in any other profession, experience and practice are required before the inspector can be depended upon to thoroughly know and understand his subject, and be

able to make practical application of his theoretical knowledge.

One of the principal points the inspector has to learn is to distinguish between when he is expected to be an expert, and when he is nothing more than a witness. The inspector is the ears and eyes of the sanitary authority; and when sent out to inspect a building, etc., he must state FACTS ONLY, and nothing more, and let his superiors draw the conclusions, etc. When, however, he is empowered to investigate the causes of a public nuisance, he becomes an expert, and here he must use sound judgment, and be prepared to support his conclusions with his theoretical knowledge and practical experience.

CHAPTER III.

TENEMENT-HOUSE INSPECTION.

The defects in tenement-houses are of three kinds:

1) Defects of construction.

2) Defects of maintenance.

3) Defects of condition.

For the first the real-estate men and builders are responsible.

The responsibility for the second rests upon the owner of the house, or his agent and housekeeper.

The fault for the third class of defects lies solely with the tenant and occupant.

A badly-constructed house may be kept in good sanitary order if the owner keeps it in good repair, and the tenants maintain it in good condition; on the other hand, the best-constructed house will be in ruins in a short time if neglected by the landlord and abused by the occupants.

So it is also between the landlord and tenant. No matter how clean the people of the house may be, the house will become a pest-hole if the landlord allows the roof to leak, the tank to fill with dirt, the sewer to be obstructed, the walls and ceilings to remain encrusted with filth. On the other hand, no matter how much the

owner may spend on maintaining his house in good repair, and on cleaning and beautifying it, the house is bound to become a menace to health and a breeding-place for bacteria, if the class of tenants is such that cleanliness is unknown among them; if they persist in tearing down walls, piling refuse everywhere, making holes in pipes, abusing fixtures, etc.

These considerations have to be kept in view in tenement-house inspection, in order to know how to inspect and whom to make responsible for the defects found and the conditions discovered detrimental to health.

An inspection of tenement-houses as to construction and defects in them, also as to light and ventilation, should be made by the building, light, and ventilation inspectors during and after construction of the building. The sanitary or tenement-house inspector should attend to the inspection of the defects of repair and maintenance of the house, while the inspection of the condition in which the house is kept by the tenants ought to be entrusted to the sanitary police.

The time an inspection of a tenement-house ought to require depends upon the kind of inspection made, as well as upon the number of stories and apartments the house contains. To peep into the cellar, glance at the privy accommodations, look up into the halls, and take in the view of the yard, may mean an inspection; and, unfortunately, many an inspector is compelled to do so from the stress of work and the enormous size of his district. But it is not an inspection, and need not take more than a few minutes of his time.

On the other hand, a thorough inspection of a house,

an examination of the construction, ventilation, light, plumbing, drainage, and condition of a five-story tenement-house, requires not only skill, experience, and patience, but also *time*, and can hardly be done in less than several hours. Such an inspection as covered in the "Notes of a Complete Inspection of a Tenement-house," in the following chapters, must take quite a few hours; but, once done, may be put on record, and will facilitate subsequent inspections of the same house. Therefore, every tenement-house ought to be inspected in such a thorough manner at least once a year, and the results of inspection carefully recorded, so that the subsequent inspections need not require as much time. This is one reason why an inspector should be kept for a long time in the same district; for, after a certain time, he becomes intimately acquainted with every house in his district, and will be better able to take care of his district and watch for defects, violations of the law, and public nuisances, than the inspector recently placed in a district.

The mode of inspecting a tenement-house may differ somewhat with every inspector. Some begin in the cellar and work up to the roof; others begin at the roof and inspect while going down to the cellar. The best way would be, in my opinion, to combine both methods, and begin in the cellar, examining and noting all defects while going up to the roof, and then go over the same field and verify, correct, and complete the inspection as one goes down again.

Here I may add one thing which the inspector must always bear in mind, and that is: to mind his own busi-

ness and *never*, NEVER talk to the owner, housekeeper, or tenants about his inspection, his work, what he finds, and what he is going to report. The inexperienced inspector may feel benevolently disposed to his fellow man, and may not be able to withstand the wiles of the ubiquitous landlord, who will want to know the report and finding of the inspector; but be assured that his every innocent remark may find its way into higher quarters, and he may find himself a victim of his own loquacity. The inspector is sent to investigate and make his report to his chief; and, until he makes such report, all he sees and discovers must not be talked about nor divulged to any one; and it is a wise policy to gently but firmly inform the too-insistent owner, or others, that the inspector must first make his report to his superior, and that in due time the owner will know what the inspector has to report.

Another matter of importance to be kept in mind during inspection of tenement-houses, as well as other inspections, is neither to be too lenient nor too strict, neither to fear nor favor the owner of the house, but always to give facts as they are and nothing more, no matter how the inspector may be treated by the caretaker or owner of the house. Some owners or agents of houses, when meeting an inspector on duty in their houses, are apt to become indignant, insolent, and overbearing; nevertheless the inspector should not be influenced by this in submitting his report. Above all, the inspector must remember his duty, his oath, and his office as guardian of the public health, and be above petty, selfish, and small considerations.

CHAPTER IV.

RULES AND REGULATIONS FOR SANITARY INSPECTORS.

In small municipalities the executive health officer performs the duties of a sanitary inspector; in larger places, however, special inspectors are appointed to examine sanitary conditions, inspect houses, report on public nuisances, etc. In New Jersey every town of 2000 inhabitants must appoint a sanitary inspector, otherwise the State Board of Health is entitled to appoint one and charge his salary to the town. There are some cities with a large population, however, where there is not one inspector. In some cities the sanitary inspectors are recruited from the regular police force. In Chicago there are 5 women inspectors. In New York, during the existence of the mercantile division of the Health Department, 10 women were employed.

Inspectors are, as a rule, always on duty; that is, they can be called any time of day or night to perform sanitary work without extra compensation. However, this is done only in cases of emergency, epidemics, and special dangers to public health. The regular time devoted by inspectors to their work varies from 6 to 9 hours a day. In New York City inspectors are required

to work from 9 A. M. till 4 P. M., with one hour for lunch. In Denver the inspection hours are from 8 A. M. to 4 P. M., with one hour for lunch. In Augusta, Ga., from 7 A. M. to 6 P. M., with two hours for lunch.

In Atlanta, Cambridge, Milwaukee, Cincinnati, Pittsburg, Columbus, Ga.; St. Paul, San Francisco, Reading (and in New York City, the tenement-house inspectors), inspectors are required to wear uniforms.

Inspectors are required to report at the office at certain times, which differ in each city. In New York inspectors report three times a week. In Denver they report daily at 4 P. M., besides being required to communicate with the office twice a day by telephone. In Providence inspectors report twice a day at the main office. In Charleston the inspectors are required to visit 50 premises daily, report at the office every day at noon, and bring a report with 50 signatures of the occupants of the premises they inspected. In most of the large cities rules and regulations are provided for the conduct of the inspectors. The most elaborate and thorough regulations are those of New York City, excerpts from which are given below:

EXTRACTS FROM THE NEW YORK CITY CHARTER OF 1901 ON SANITARY INSPECTORS.

"Sec. 1185. **Sanitary Inspectors.**—The Board of Health shall appoint and commission at least fifty sanitary inspectors (this is exclusive of the Police and the other divisions of the Department, such as contagious diseases, food, offensive trades, schools, etc.), and shall have power to appoint 20 additional sanitary inspectors, if it deems that number necessary, and from time to time to prescribe the duties of each of said inspectors, and the place of their performance, and of all other persons exercising

any authority under said Department, except as herein specially provided; but 30 of such inspectors shall be physicians of skill and of practical professional experience in said city. The additional sanitary inspectors heretofore duly appointed and commissioned, either in New York City or in the City of Brooklyn, may be included among the sanitary inspectors mentioned in this section, and may continue to act as such without reappointment, but nothing herein contained shall curtail any of the powers vested in the Department of Health by this act, and the number of sanitary inspectors for whom provision is made in this section shall be exclusive of the special inspectors for whom provision is made in section 1186 and elsewhere in this act. All of the said inspectors shall have such practical knowledge of scientific or sanitary matters as qualify them for the duties of their office. Each of such inspectors shall, once in each week, make a written report to said Department, stating what duties he has performed, and where he has performed them, and also such facts as have come to his knowledge connected with the purposes of this chapter as are by him deemed worthy of the attention of said Department, or such as its regulations may require of him; which reports, with the other reports herein elsewhere mentioned, shall be filed among the records of the said Department."

"Sec. 1321. **Pension for physician or employee disabled by reason of performance of duty.**—The board of trustees of said fund shall have power to grant as pension to any physician or employee in the Health Department of The City of New York, who shall, as a consequence of the actual performance of his duty, and without any fault or misconduct on his part, have become permanently disabled physically or mentally, so as to be unfit to perform full duty, a sum not to exceed one-half, nor less than one-fourth of his rate of compensation per annum as such physician or employee, as the case may be.

"Sec. 1322. **Pensions to personal representatives of physician or employee who shall die from disease or injuries suffered in consequence of his performance of duty.**—Whenever such physician or employee shall die while in the service of the Health Department from disease contracted or injuries sustained by him as a consequence of the actual performance of his duty, without any fault or misconduct on his part, leaving a widow, the said board of trustees of said pension fund may grant, award or pay

to the widow of said physician or employee the sum of $300 annually, during her life, so long as she remains a widow; and if there be no widow of any such physician or employee, but he shall leave minor children under eighteen surviving him, then said $300 may be given, awarded and paid to said children under eighteen years of age."

"Sec. 1323a. **Pension for twenty years' service.**—Any physician or employee who has or shall have performed duty as such physician or employee in any Department of Health in The City of New York, for a period of 20 years, or upward, upon his own application, in writing, or upon a certificate and report of a board of physicians, appointed by the Board of Health, certifying that such physician or employee is permanently disabled, so as to be unfit for further duty as such physician or employee shall be retired from active service by resolution of the Board of Health of the Health Department of The City of New York, and placed upon the Health Department pension roll, and thereupon shall be awarded, granted, and paid from said Health Department pension fund by the trustees thereof, an annual sum during his lifetime not exceeding one-half the ordinary full pay of a physician or employee in the Health Department service of the rank of the physician or employee so retired; provided, however, that no pension granted under this or the preceding sections, shall exceed the sum of $1200 per annum. Pensions granted under this section shall be for the natural life of the person receiving the same, and shall not be revoked, repealed, or diminished."

EXTRACTS FROM THE RULES AND REGULATIONS OF THE DEPARTMENT OF HEALTH, NEW YORK CITY, ON SANITARY INSPECTORS.

"The Sanitary Superintendent, the Assistant Sanitary Superintendents, and all Inspectors shall be considered always on duty."

"All officers and employees of the Department of Health shall be at all times courteous and respectful to all persons with whom they come in contact in the performance of their duties; all officers and employees of the Department of Health must be protected from smallpox by proper vaccination. Intoxication or the use of intoxicating beverages during the hours of service are strictly forbidden."

"Inspectors have general charge, and must be held responsible for the sanitary condition of their respective districts. It is their duty to report in writing all violations of the law, Sanitary Code and regulations of the Board coming under their observation, whether such violations belong to the class under their especial charge or not. Such reports should be accompanied with recommendations and suggestions for the consideration of the Sanitary Superintendent."

"Inspectors shall wear their badges prominently displayed when engaged in their official duties. On entering any house or premises they must announce their authority and the object of their visit, and, while endeavoring to avoid giving offence, must make their investigations minutely. If resistance is offered to an Inspector in the performance of his duties, he will at once report the fact.

"Every Sanitary Inspector and every Medical Inspector not a Diagnostician, and every Vaccinator, must give to the work of this Department seven hours daily, except on Sundays and legal holidays. Saturday being a half holiday by statute, three hours will constitute a Saturday's work. When compliance with this rule is impossible, resignations will be expected.

"Inspectors must carefully inspect premises mentioned in complaints referred to them and make full and intelligent reports thereon. The modification of orders is undesirable, and should be rendered unnecessary by the intelligence and completeness of Inspector's recommendations. They are required to make reinspections promptly and carefully. A delay of more than forty-eight hours in making a reinspection must be reported to the President, unless such delay is authorized by the Chief Sanitary Inspector, who will thus assume the responsibility. Discretion in permitting a tardy compliance with an order rests with the Board and not with the Inspector.

"Inspectors will be held responsible for the existence of remediable public nuisances within their respective districts, and are expected to find them by original inspection. If unable to secure their prompt correction by personal efforts, they must report them to the Board, taking special care to correctly name the owners. When not otherwise employed on official business, they are expected to make a house-to-house inspection of tenements, factories, and all causes of nuisance in their districts. The law

gives the Board of Health power to require that such conditions shall be thoroughly and properly corrected, and when this is impracticable, to vacate houses. It is prepared to use this power The object of assigning Inspectors to districts is to familiarize them with local conditions. Every Inspector is expected to know his district intimately, and his efficiency will be judged not so much by what he claims to have done as by the sanitary condition of his district. The existence there of undiscovered and unreported nuisances which should have been found and reported will be held to indicate incompetence or unfaithfulness."

NUMBER OF SANITARY AND OTHER INSPECTORS IN THE FOLLOWING CITIES.

NOTE.—The following list, which is of course incomplete, is based on Dr. Chapin's book:

	Sanitary Inspectors.	Plumbing Inspectors.	Food Inspectors.	Infectious Diseases. Inspectors.	School Inspectors.	Tenement-house Inspectors.
Allegheny	......	2	1			
Asbury Park	2					
Atlanta	7					
Augusta	5	......	......	4		
Baltimore	6	1	2	4		
Boston	16	11	4	2		
Brockton	......	2				
Brookline	1	.....	1			
Buffalo	6	......	......	1		
Cambridge	3	1	......	4		
Charlestown	4					
Chicago	34	14	9	20	50	
Cincinnati	20	2	......	4		
Cleveland	20	......	4			
Columbus	8	1	1			
District of Columbia	7	......	3	1		
Dayton	2	1				
Denver	11	2	2	2		
Evansville	1	......	1			
Fitchburg	......	1	1			
Hartford	2	1	......	1		

NUMBER OF SANITARY AND OTHER INSPECTORS IN THE FOLLOWING CITIES.—*Continued.*

	Sanitary Inspectors.	Plumbing Inspectors.	Food Inspectors.	Infectious Diseases.	School Inspectors.	Tenement-house Inspectors.
Haverhill	......	1	1			
Holyoke	......	1				
Indianapolis	6					
Lawrence	......	2				
Lowell	4					
Lynn	2	1	2			
Louisville	......	......	1			
Manchester	2					
Memphis	12					
Milwaukee	13	4	4	5		
Minneapolis	7	2	3	3		
New Bedford	......	1	......	1		
Newark	15	1	2	1		
New Haven	4	1				
New Orleans	19	......	14			
Newton	3	1	......	......	7	
New York	61	50	20	50	200	200
Omaha	......	......	......	1		
Paterson	......	1				
Pittsburg	17	5	2	1		
Philadelphia	......	13	4	5		
Providence	2	3	1	1		
Reading	......	1				
Richmond	4					
Rochester	5	......	......	1		
St. Paul	6	......	2	1		
St. Louis	......	......	6			
Salt Lake City	1	......	......	1		
San Francisco	5	5	13			
Somerville	1	1				
Springfield, Mass	......	1				
Syracuse	2	2	1			
Toledo	10					
Utica	3					
Wilmington, Del	4					

CHAPTER V.

CIVIL-SERVICE EXAMINATIONS.

A civil-service examination is not the best test of the fitness of a candidate; but in the absence of any better, and in the absence of proper schools for sanitary training, such examinations show, at least, whether a candidate has any knowledge of the subject in which he is examined.

The questions put in the various sanitary examinations are, as a rule, fair, and not very difficult for any one with a knowledge of sanitation to answer. A very important part of the examination is that containing the questions bearing on the local laws of the department in which the examination is held, and the candidate must make a thorough study of these laws.

From 10 to 30 questions are given to the applicant, who has from 5 to 6 hours in which to answer them. Among so many questions there are a number which are easy to answer, a number somewhat more difficult, and a few to answer which may not be possible to the candidate. The best procedure is to begin with the easiest questions first; answer them as thoroughly as possible, then to proceed to the more difficult and leave the most difficult for the last; otherwise, if the appli-

cant begins with the hard questions first, he is discouraged, loses the time in which he might be answering the easier questions, and loses all spirit and hope, so that he is unfit to give good answers to questions which at first would have been very easy. The answers and explanations must be clear, short, and to the point. The candidate is not expected to write a treatise on each subject, but merely to give a clear and readable opinion, so that the examiner may judge how much the applicant knows of the subject. Legible handwriting is a great advantage in civil-service examinations, as the examiners are but human, and often in despair of deciphering the writing of an able paper, may give up the task and leave the candidate with a low percentage.

EXTRACTS FROM THE MUNICIPAL CIVIL-SERVICE RULES OF THE CITY OF NEW YORK.

"Appointments and promotions in the Civil Service of The City of New York shall be made according to merit and fitness, to be ascertained, by examinations which, so far as practicable, shall be competitive.

"Every false statement knowingly made by any person in his application for examination, and every connivance by him at any false statement made in any certificate which may accompany his application, shall be regarded as good cause for the removal or discharge of such person.

"No candidate for positions requiring technical or professional knowledge receiving less than 75 per cent on the technical or special subjects shall be placed upon the eligible list. No applicant receiving 0 in any one subject shall be placed upon the eligible list.

"Every original appointment to or employment in any position in the competitive class shall be made for a probationary term of three months, and an appointing or nominating officer, in notifying

a person certified to him for appointment or employment, shall specify the same as for a probationary term only; and if the conduct, capacity, and fitness of the probationer are satisfactory to the appointing officer, his retention in the service, after the end of such term, shall be equivalent to his permanent appointment; but if his conduct, capacity, or fitness be not satisfactory, he may be discharged at the end of such term, without regard to the provisions of Rule 42 limiting the power of removal.

"No person dismissed from the service for delinquency or misconduct shall be eligible to appointment in any capacity in any department of the Municipal service within two years.

"To secure compliance with the provisions of the Civil Service Law prohibiting removals because of political opinions or affiliations, no removal of any person in the classified service of the City of New York shall be valid unless and until a statement of the causes of such removal shall be filed with the Municipal Commission and a copy of the same furnished to the person sought to be removed, and until such person has been afforded an opportunity to present an explanation in writing."

Schedule D comprises all positions requiring special expert knowledge, and which are not included in Schedule E.

Schedule E comprises all positions calling for medical service.

SCHEDULE D.

Rule 56. The Board of Examiners shall examine every applicant eligible under these rules for a position in Schedule D, and shall give a certificate of qualification to such person only when satisfied:

First. That he (or she) is within the limits of age prescribed for the situation named.

Second. That he (or she) is free from any physical defect or disease likely to interfere with the proper discharge of his (or her) duties.

Third. That his (or her) character is such as to qualify him (or her) for such employment; and

Fourth. That he (or she) possesses the requisite knowledge and ability to enter upon the discharge of the duties of such situation or employment.

The fourth article of the certificate shall be determined by the Examining Board from the results of the competitive examination of the different persons applying for the position to which the appointment is to be made. The examination shall have reference to the special qualifications, expert or otherwise, required for that particular position, and shall be practical in its character.

Rule 57—Part I. The general examination for admission to the subordinate places in Schedule D (being Part I. of the classification hereto annexed) shall be in writing and on the following subjects:

1. Handwriting (as shown in examination papers).
2. Arithmetic, viz.: addition, subtraction, multiplication, and division.
3. Questions relating to the technical knowledge required for the position sought by the applicant.
4. Experience tending to qualify him for that position.

In addition to this, the health and physical vigor of the applicant shall be tested, as hereinafter required.

The relative weight to be given to these several subjects in making up the average standing shall be as follows:

1. Handwriting	1
2. Arithmetic	1
3. Technical knowledge	6
4. Experience	2
Total of weights	10

Rule 57—Part II. No person shall be admitted as a competitor for appointment to any of the superior positions in Schedule D (being Part II. of the classification hereto annexed), who shall not present to the Examining Board satisfactory evidence that he has received a diploma or certificate from some reputable institution showing that he has pursued in such institution, with credit for two years, a course of study adapted to qualify him for the position which he seeks, or for which his appointment is desired.

He may, however, produce in lieu of such diploma or certificate,

certificates from one or more professional men in good standing, to the effect that he has pursued with them or under their direction, and with credit to himself, a course of study similar to that before mentioned for the last three years.

Those admitted to competition for the superior positions in Schedule D shall be examined in writing on the following subjects:

1. The technical knowledge required for the position to be filled, and respecting which the examination is held.
2. Experience tending to qualify the applicant for that position.
3. Mathematics.
4. Example of a report on the subject.

The relative weight to be given to these several subjects shall be as follows:

1. Technical knowledge	50
2. Experience	15
3. Mathematics	20
4. Report, etc	15
Total of weights	100

SCHEDULE E.

Rule 58. The general examination for admission to places classified in Schedule E shall be in writing and on the following subjects:

1. The technical knowledge required for the position to be filled.
2. Experience tending to qualify the applicant for that position.

The relative weight given to the subjects shall be as follows:

Technical knowledge	6
Experience	4
Total of weights	10

CHAPTER VI.

NOTES ON AN INSPECTION OF A TENEMENT-HOUSE.

A.

Street	No. ....
Owner	Address ....
Agent	Housekeeper ....
Inspection made on...........	Character of house.............
Date inspected................	Date reported..................

B.

Material of building..........	No. of stories.................
No. of apartments............	No. of rooms..................
No. of families...............	No. of adults..................
No. of children of 2–12 years...	No. of children under 2 years...

C.

Size of lot....................	Size of house..................
Size of yard..................	Size of air-shafts..............
Size of halls..................	Size of water-closet apartments..
Size of main rooms...........	Size of bedrooms...............
Size of kitchens..............	Cellar ....
Size of windows: rooms........	Halls ....
" " " w.c. apmts...	Cellar ....

D. LIGHT AND VENTILATION.

Halls	Cellar ....
Bedrooms	Kitchens ....
Main rooms...................	W.C. apartments...............

Air-space.

Main rooms............... Bedrooms ....

Apartments............... W.C. apartments...............

How lighted at night.

Halls .... Rooms ....

How heated.

Halls .... Rooms ....

E. PLUMBING.

House-drain:	Material.........	Size ....
	Location.........	Position ....
	How supported...	Fall ....
	Joints of lengths.	With soil- and waste-pipes......
	With house-sewer.	Rain-leader ....
	Main trap........	Fresh-air inlet.................
Soil: waste:	How many lines..	Materials ....
Vent-pipes:	Sizes............	Location ....
	Joints	Extension ....
	Connection with traps	With house-drain...............
Rain-leader:	Material	Location ....
	Joints	Trapped........................

Fixtures.

Sinks No....................	Materials ....
Enclosed?	Backs ....
Traps, kind..................	Material ....
Size	Joint to fixture...............
Joint to main waste..........	How far from fixture?..........
Water-closets, No.............	Type...........................
Seats	Traps ....
Size	Material ....
Connection with fixture........	With main soil-pipe............
How flushed?..................	Capacity of cisterns...........
Size of flush-pipe.............	Cisterns how far?..............

Tank.

Material	Capacity ....
Location	Cover ....
Overflow	How supplied?..................

Water-supply.
Size of main pipe.......... Material ....
Size of branches.......... Material ....
Remarks ....
....
....

F. CONDITION.

Yard.............flagged, graded, drained?...................
Fire-escapes ....
Air-shafts ....

Cellar floor..................		Walls ....
Ceilings		Windows ....
Woodsheds, etc...............		Gratings and doors............
Any one living in cellar?......		Permit? ....
Halls:	Floors	Walls ....
	Ceilings	Wainscoting...................
Roof:	Material	Condition ....
	Washroof	Eaves gutter..................
	Doors	Skylight ....
Chimney:	Size	Height above roof.............
	Material	Condition ....
Rooms:	Flooring	General cleanliness............
	Walls	Ceilings ....
W.C. Apmts.:	Floor material....	Condition ....
	Walls	Ceilings ....
	Windows	Space under w.c................
Plumbing:	House-drain	Sinks.........................
	Soil-pipe	Water-closets..................
	Waste-pipe	Tank..........................
	Vent-pipe	Water-supply pipe..............
	Rain-leader	Faucets........................
	Sink traps.......	Fresh-air inlet................
	W. C. traps......	

Remarks ....

CHAPTER VII.

EXAMPLE OF A REPORT OF AN INSPECTION OF A TENEMENT-HOUSE.

Department of................of the City of....................
Complaint and report of Inspector in reference to premises.......
....

I, John Jones, holding the position of Tenement Inspector in the Department of..............of the City of.............do report that on the.........................19.. I personally examined and carefully inspected the premises situated at................ said premises consist of a tenement-house of 18 families of which Mr. ....is owner and responsible; and I herewith respectfully submit the following report of the conditions found which are in my opinion dangerous to life and detrimental to health, and are in violation to the tenement-house law, viz.:

That the halls are not sufficiently ventilated, there being no windows to the outer air, nor any ventilators in roof over halls.

That the 2d floor hallway is dark during daytime, and that no light is kept burning at night in the entrance and 3d floor halls.

That the underground earthenware house-drain in cellar is defective, allowing foul gases and liquids to escape therefrom.

That the joints of the iron soil-pipes on 2d floor are defective, the connection of the main soil-pipe with the branch soil-pipe from 3d floor water-closet is made by a cement joint and is defective, allowing foul gases to escape therefrom.

That foul gases escape from the holes in the lead traps of sink on 1st floor apartment No. 3, of wash-tub in apartment 6, of bathtub in apartment 12; from the holes in the iron main waste-pipe

in cellar, and from the defective connection of the lead trap of sink in apartment No. 18 with the main iron waste-pipe thereat.

That the long-hopper closets in the halls are old, corroded, and cannot be properly cleaned.

That the waste-pipe from the refrigerator in the store on ground floor is connected with the house-drain, allowing foul gases to enter refrigerator from house-drain.

That the yard and the air-shafts on the east and west sides of the house are not paved, nor graded and drained, allowing surface water to stagnate thereon.

That the rear fire-escape on 3d floor is obstructed with bedding, etc.

That the cellar is not cemented and is damp.

That the walls and ceilings of cellar are dirty and offensive.

That the floors, the wainscoting, and the painted walls and whitewashed ceilings of halls are dirty and offensive.

That the roof leaks, causing dampness.

That the chimney is defective, allowing coal-gas and smoke to enter rooms.

That the paper on walls and ceilings of apartments Nos. 1, 2, 4, 8, 9, 14, 16, and 18 is dirty and offensive.

That the tank on roof is not properly covered, and the tank dirty with sediments of dirt, etc.

That there is no housekeeper residing on premises.

I herewith respectfully recommend

That a ventilating skylight be provided in roof over the stair-well in the hall, said skylight shall have both ridge ventilators and fixed louvers, the glazed surface thereof to be not less than 25 square feet in area.

That a light be kept burning in the 2d floor hallway from 8 A.M. till 10 P.M., and on all other floors from sunset till 10 P.M., and in the entrance hall and the 3d floor from sunset till sunrise every night throughout the year.

That the defective earthenware house-drain be removed, its site cleaned and disinfected, and filled in with fresh earth, and replaced by extra heavy cast-iron pipe, at least 6 inches in diameter, with all joints properly lead-calked, and connected with the house-sewer by a gas-tight joint; and the main iron soil, waste and rain-

leader pipes to be connected with said house-drain with proper joints gas-tight; and that said house-drain be provided with a fresh-air inlet of similar material, at least 4 inches in diameter, and with running trap, placed near the front wall of building, provided with proper handholes and trap screw-ferrules.

That the defective joints of the iron soil-pipe on 2d floor be recalked gas-tight, and the connection of the lead branch soil-pipe of the water-closet with the main soil-pipe thereat be made by a brass ferrule, lead-wiped and calked.

That the holes in the lead traps of sink in apartment No. 3, of wash-tub in apartment 6, of bath-tub in apartment 12, be soldered gas-tight, the holes in the main iron waste-pipe in cellar be closed with iron bands. gas-tight, and the connection of the lead trap of sink in apartment No. 16 with main iron waste-pipe be made by means of a brass ferrule properly lead-wiped and calked.

That the old, corroded, and defective long-hopper water-closets in the halls be removed, and replaced by new earthenware, flush-rim washout water-closets flushed from a proper metal-lined flushing cistern properly adjusted over the same with a flush-pipe of 1¼-inch diameter.

That the waste-pipe from the refrigerator in the store on ground floor be disconnected from the house-drain, the opening at disconnection closed gas-tight, and said waste-pipe made to discharge into a properly-trapped, sewer-connected, water-supplied, open sink.

That the air-shafts on east and west sides and the yard be properly flagged or cemented, and so graded as to discharge all surface-water into properly-trapped, sewer-connected drains.

That all obstructions be removed from the rear fire-escape on 3d floor.

That the floor of cellar be properly cemented and made impervious to dampness.

That the walls and ceilings of cellar be cleaned and whitewashed.

That the wooden flooring and wainscoting, and the painted walls of halls, be thoroughly scrubbed and cleaned, and their ceilings whitewashed.

That the roof be repaired so as not to leak.

That all defects in the chimney be repaired, and the nuisance caused by smoke and coal-gas from it entering living rooms be abated.

That all the dirty paper be removed from the walls and ceilings of apartments Nos. 1, 2, 4, 8, 9, 14, 16, and 18, and said walls and ceilings be either repapered or painted.

That the tank on roof be emptied, cleaned of all deposits and sediments, scrubbed and provided with a properly-fitting air-tight cover.

That a housekeeper be engaged to reside on premises.

Respectfully submitted,

John Jones,
Tenement-house Inspector.

CHAPTER VIII.

CALCULATION OF AREAS AND CUBIC SPACE.

In investigating overcrowding of lodging-houses or tenements, it is often necessary to find out the cubic space of rooms in order to show how many people may inhabit them. The following rules will be helpful for this purpose :

The *floor-space* of a room is the width of the room multiplied by its length.

The *cubic space* of a square or rectangular room is the width multiplied by the length, and the result again multiplied by the height.

The *area of a triangle* will be the base multiplied by $\frac{1}{2}$ the height, or the height multiplied by $\frac{1}{2}$ the base.

The *cubic space of a triangle* equals the area of the section multiplied by its depth.

The *area of a circle* equals the square of the diameter multiplied by 0.7854.

The *cubic capacity of a sphere* equals the cube of the diameter multiplied by .5236.

Projections of chimneys, furniture, etc., must be deducted from the cubic space of the room.

A grown person occupies about 3 cubic feet of space.

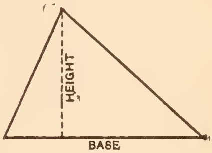
The minimum of air-space in a lodging-house for each individual is 400 cubic feet.

The minimum of air-space in a workshop for each individual is 250 cubic feet.

The minimum of air-space in a tenement-house for each individual is 600 cubic feet.

The following reprint on the calculation of areas is taken from the "Sanitary Record Diary for 1901."

TRIANGLE.



Area = Half the product of base and height.

This may be obtained by multiplying the base by the height and halving the product, or by multiplying the base by half the height or the height by half the base.

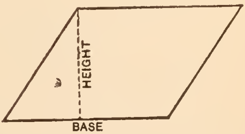
QUADRILATERAL OF FOUR-SIDED FIGURES.

Rectangle and square (in both of which all angles are square).

Area = The length multiplied by the breadth.

Rhombus or rhomboid (in which the opposite sides are parallel).

Area = The base multiplied by the perpendicular height.

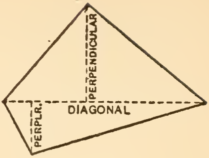


Trapezoid (in which two sides only are parallel).

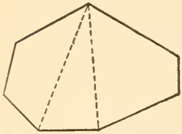
Area = The mean length of the parallel sides multiplied by the perpendicular distance between them.

Trapezium (which has none of its sides parallel).

Area = Half the sum of the perpendiculars multiplied by the diagonal on which they fall.

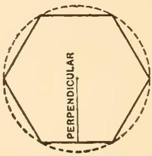


POLYGONS.



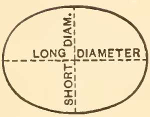
Irregular polygons may be divided into triangles {or / and} trapeziums and the areas found by the foregoing rules.

Regular polygons. Area = The sum of the sides (perimeter) multiplied by half the perpendicular (drawn from the centre to the middle point of any side) *or* half the perimeter multiplied by the perpendicular, *or* square the length of one side and multiply by—



1·72 if pentagon (5-sided)
2·598 if hexagon (6-sided)
3·634 if heptagon (7-sided)
4·828 if octagon (8-sided)
6·182 if nonagon (9-sided)
7·694 if decagon (10-sided)

ELLIPSE.

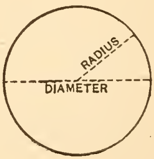


Area = The long and short diameters multiplied together and the result multiplied by .7854.

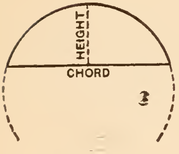
CIRCLE.

Area = Square of diameter multiplied by ·7854 *or* square of radius multiplied by 3.1416.

NOTE.—The area of a circle is equal to that of a triangle whose base and altitude are equal to the circle's circumference and radius.



SEGMENT OF A CIRCLE.

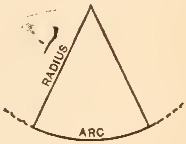


Area = The cube of the height divided by twice the length of the chord added to two-thirds of the product of chord and height, *or* the area of the sector which has the same arc, less the area of the triangle formed by the radii and the chord.

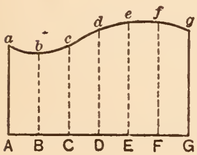
NOTE.—When the segment is greater than a semicircle, find the area of the circle and deduct the area of the smaller segment.

SECTOR OF A CIRCLE.

Area = Half the product of the arc multiplied by the radius, *or* length of arc multiplied by half the radius, *or* the number of degrees in the arc multiplied by the area of the circle and divided by 360.



CURVILINEAL FIGURES.

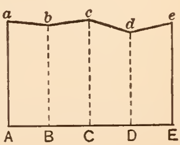


Area = The first ordinate + the last ordinate + twice the sum of all other odd ordinates + four times the sum of all even ordinates, multiplied by one-third of the distance between two adjacent ordinates.

NOTE.—The ordinates should be drawn equidistant and the divisions made even in number. In the figure *a* A is the first ordinate, *g* G the last, *b* B, *d* D, and *f* F the even, and *c* C and *e* E the odd ordinates.

IRREGULAR FIGURES.

Area = The mean of the extreme ordinates added to the sum of the intermediate ones and multiplied by the whole length of the figure divided by the number of ordinates less one.



NOTE.—The areas of other irregular figures may be ascertained by dividing the latter into squares, triangles, and segments, finding the areas of each of these separately, and then adding them together.

CUBIC SPACE.

Cubic space or contents is arrived at by multiplying the area of the base by the perpendicular height when the latter is uniform over the whole area. If the contrary be the case, the mean, or average, height must be ascertained and the area multiplied by it.

CHAPTER IX.

USEFUL INFORMATION FOR SANITARY ENGINEERS AND INSPECTORS.

(Compiled by Gerard J. G. Jensen, C.E.)

Reprinted from the "Sanitary Record Diary for 1901."

In the following tables the British gallon is given. The same tables in American measure are printed on page 220*a et seq.*

HYDRO-MEMS, ETC.

1 cub. ft. of fresh water = { 62.425 lb. / 0.557 cwt. / 0.028 ton / 6.2355 gals.

1 gallon = { 10 lb. / 0.16 cub. ft. / 276.48 cub. in.

1 cwt. = { 1.8 cub. ft. / 11.2 gals.

1 cub. in. of fresh water = { 0.03612 lb. / 0.003607 gals.

1 ton = { 35.84 cub. ft. / 224 gals.

TABLE OF PRESSURE AND THEORETICAL VELOCITY OF WATER UNDER VARIOUS HEADS.

Head of water in ft.	Pressure in lb. per sq. in.	Velocity in feet per second.	Head of water in ft.	Pressure in lb. per sq. in.	Velocity in feet per second.
1	0.4335	8.025	17	7.369	33.088
2	0.867	11.349	18	7.803	34.047
3	1.30	13.90	19	8.236	34.98
4	1.734	16.05	20	8.670	35.889
5	2.1675	17.945	25	10.837	40.125
6	2.601	19.657	30	13.005	43.954
7	3.034	21.232	35	15.172	47.476
8	3.468	22.698	40	17.340	50.755
9	3.901	24.075	45	19.507	53.833
10	4.335	25.377	50	21.675	56.745
11	4.768	26.615	55	23.842	59.515
12	5.202	27.799	60	26.010	62.161
13	5.635	28.935	70	30.345	67.142
14	6.069	30.027	80	34.680	71.778
15	6.502	31.081	90	39.015	76.131
16	6.936	32.10	100	43.350	80.25

DRAINAGE.

The velocity of the flow in drains should be from 3 ft. to 4.5 ft. per second.

An easy rule for determining the proper inclination at which drains should be laid is to multiply the diameter of the drain (in inches) by 10. The result will be the number of feet in which the drain should fall 1 ft.; thus,

4 in. = 1 in 40. 6 in. = 1 in 60.

TABLE OF FALL NECESSARY TO OBTAIN CERTAIN VELOCITIES (IN FEET PER SECOND) IN DRAINS RUNNING FULL OR HALF FULL.

Dia. of drain in inches.	V = 2.5.	V = 3.	V = 3.5.	V = 4.	V = 4.5.	V = 5.	V = 5.5.	V = 6.
	1 in	1 in	1 in	1 in	1 in	1 in	1 in	1 in
4	129	92	68	53	42	34	29	24
5	161	115	85	66	52	42	36	30
6	193	137	102	80	62	51	43	36
9	290	206	154	119	95	77	65	54
12	386	275	205	159	127	103	86	72

RELATIVE DISCHARGING POWER OF PIPES.

(When the fall and the length of the pipes remain constant, the discharge varies as the square root of the fifth power of the diameter, or as $d^{2.5}$).

Diameter of pipe.	$d^{2.5}$
$2\frac{1}{2}$	9.88
3	15.59
4	32.0
5	55.9
6	88.18
9	243.0
12	498.8
15	871.4
18	1375.0
24	2822.0
30	4930.0
36	7776.0

TABLE OF CONTENTS OF WELLS IN GALLONS.

Diameter of Well. ft.	in.	Contents in gals. per ft. of Depth.
2	6	30.62
3	0	44.10
3	6	60.02
4	0	78.40
4	6	99.32
5	0	122.50
5	6	148.22
6	0	176.40

CAPACITY AND USUAL PROPORTIONS OF CISTERNS.

Contents.	Length.		Width.		Depth.		Contents.	Length.		Width.		Depth.	
Gals.	Ft.	In.	Ft.	In.	Ft.	In.	Gals.	Ft.	In.	Ft.	In.	Ft.	In.
20	1	10	1	4	1	4	150	3	6	2	7	2	8
25	2	0	1	5	1	5	175	3	8	2	9	2	9
30	2	0	1	6	1	7	200	3	10	2	11	2	11
40	2	3	1	8	1	8	250	4	2	3	3	3	0
50	2	5	1	10	1	10	300	4	6	3	7	3	0
60	2	6	1	11	2	0	350	5	6	3	6	3	0
70	2	8	2	2	2	0	400	6	0	3	6	3	2
80	2	10	2	3	2	0	500	6	6	3	8	3	6
90	3	0	2	5	2	0	600	7	0	4	0	3	6
100	3	2	2	3	2	3	800	8	1	4	7	3	7
125	3	4	2	7	2	4	1000	9	1	5	1	3	7

FORMULÆ FOR CALCULATING THE CAPACITY OF DRAIN AND OTHER CYLINDRICAL PIPES.

$D =$ Diameter of pipe in inches.
$A =$ Area of pipe in square inches.
$L =$ Contents per foot of pipe in lb.
$F =$ " " " " cub. ft.
$G =$ " " " " gallons.

$$L = D^2 \times .34 \qquad L = \frac{A}{2.31}.$$

$$F = D^2 \times .00544 \qquad G = D^2 \times .034.$$

TABLE OF VELOCITY (IN FEET PER MINUTE) AND DISCHARGE (IN GALLONS PER MINUTE) OF DRAINS, WITH VARIOUS FALLS, WHEN RUNNING FULL.

Diameter.	4 Inches.		5 Inches.		6 Inches.	
Fall.	Velocity	Discharge.	Velocity	Discharge.	Velocity	Discharge.
1 in 20	395	214.90	441	375.40	481	589.18
1 in 25	353	192.07	395	335.52	432	529.15
1 in 30	322	175.21	360	306.07	395	483 84
1 in 35	298	162.18	333	283.31	366	448.34
1 in 40	278	151.25	311	264.21	342	418,95
1 in 45	261	142.02	291	248.09	322	394.43
1 in 50	246	134.04	278	234.15	307	375.46
1 in 60	226	123.11	253	215.06	279	341.20
1 in 70	209	113.88	234	198.93	257	314.31
1 in 80	194	105.71	217	184.66	239	292.28
1 in 90	182	99.15	203	173.20	225	275.18
1 in 100	172	93.72	192	163.71	213	260.52

Diameter.	9 Inches.		12 Inches.	
Fall.	Velocity.	Discharge.	Velocity.	Discharge.
1 in 20	582	1604.30	664	3254.16
1 in 25	525	1447.60	600	2940.28
1 in 30	481	1326.00	551	2700.67
1 in 35	446	1229.30	513	2514.09
1 in 40	418	1152.53	481	2357.47
1 in 45	395	1088.80	454	2225.19
1 in 50	375	1033.90	432	2115.98
1 in 60	343	945.98	395	1935.03
1 in 70	317	874.22	366	1792.75
1 in 80	296	816.19	342	1675.44
1 in 90	279	769.39	322	1577.47
1 in 100	264	728.21	306	1498.85

USEFUL INFORMATION FOR SANITARY ENGINEERS AND INSPECTORS.

(Compiled by William Kent, M.E.)

WEIGHT OF WATER.

1 cub. ft. of fresh water at 62° F. =	62.355 lb. 0.03118 net ton 7.4805 gals.	1 U. S. gal. =	8.336 lb. 0.13368 cub. ft. 231 cub. in.
1 cub. in. of fresh water =	0.036085 lb. 0.004329 gal.	1 net ton (2000 lb.) =	32.074 cub. ft. 239.93 gals.

TABLE OF PRESSURE AND THEORETICAL VELOCITY OF WATER UNDER VARIOUS HEADS.

Head of water in ft.	Pressure in lb. per sq. in.	Velocity in feet per second.	Head of water in ft.	Pressure in lb. per sq. in.	Velocity in feet per second.
1	0.433	8.02	17	7.361	33.1
2	0.866	11.4	18	7.794	34.0
3	1.299	13 9	19	8.227	35.0
4	1.732	16.0	20	8.660	35.9
5	2.165	17.9	25	10.825	40.1
6	2.598	19.7	30	12.990	43.9
7	3.03	21.2	35	15 155	47.4
8	3.464	22.7	40	17.320	50.7
9	3 897	24.1	45	19.485	53.8
10	4.330	25.4	50	21.650	56.7
11	4.763	26.6	55	23.815	59.5
12	5.196	27.8	60	25.980	62.1
13	5.629	28.9	70	30.310	67.1
14	6.062	30.0	80	34.640	71.8
15	6.495	31.1	90	38.970	76.1
16	6.928	32.1	100	43.330	80.2

CONTENTS OF WELLS IN U. S. GALLONS.

Diameter of Well. ft.	in.	Contents in gals. per ft. of depth.
2	6	36.72
3	0	52.88
3	6	71.97
4	0	94.00
4	6	118.97
5	0	146.88
5	6	177.22
6	0	211.51

CAPACITY OF RECTANGULAR CISTERNS.

Length in feet.	Width in feet.	Depth in feet.	U. S. Gallons.	Length in feet.	Width in feet.	Depth in feet.	U. S. Gallons
2	1	1	14.96	5	2½	2½	233.8
2	1½	1½	33.66	5	3	2½	280.5
2½	1½	1½	42.08	5	3	3	336.6
2½	2	1½	56.10	5	4	3	448.8
2½	1½	2	74.80	5	4	4	598.4
3	1½	1½	50.49	6	3	3	403.9
3	2	1½	67.32	6	3½	3½	550.5
3	2	2	89.76	6	4	4	718.1
4	2	2	119.7	7	3½	3½	641.4
4	2½	2½	187.0	7	4	4	837.8
4	3	2	179.5	7	5	5	1309
4	3	2½	224.4	8	5	5	1496

FORMULÆ FOR CALCULATING THE CAPACITY OF DRAIN AND OTHER CYLINDRICAL PIPES.

D = Diameter of pipe in inches.

A = Area of pipe in square inches.

L = Contents per foot of pipe in lbs.

F = " " " " " " cub. ft.

G = " " " " " " gallons.

$L = D^2 \times 0.34$ $\qquad$ $L = A \times 0.433.$

$F = D^2 \times 0.005454$ $\qquad$ $G = D^2 \times 0.408$ (U. S. gals.).

TABLE OF VELOCITY (IN FEET PER MINUTE) AND DISCHARGE (IN GALLONS PER MINUTE) OF DRAINS WITH VARIOUS FALLS WHEN RUNNING FULL.

Diameter.	4 Inches.		5 Inches.		6 Inches.	
Fall.	Velocity	Discharge.	Velocity	Discharge.	Velocity	Discharge
1 in 20	395	257.88	441	450.48	481	707.02
1 in 25	353	230.49	395	402.62	432	634.98
1 in 30	322	210.25	360	367.28	395	580.61
1 in 35	298	194.62	333	339.97	366	538.01
1 in 40	278	181.50	311	317.05	342	502.74
1 in 45	261	170.42	291	297.71	322	473.32
1 in 50	246	160.85	278	280.98	307	450.55
1 in 60	226	147.73	253	258.07	279	409.44
1 in 70	209	136.66	234	238.72	257	377.17
1 in 80	194	126.85	217	221.59	239	350.74
1 in 90	182	118.98	203	207.84	225	330.22
1 in 100	172	112.46	192	196.45	213	312.62

Diameter.	9 Inches.		12 Inches.	
Fall.	Velocity.	Discharge.	Velocity.	Discharge.
1 in 20	582	1925.16	664	3904.97
1 in 25	525	1737.12	600	3528.34
1 in 30	481	1591.20	551	3240.80
1 in 35	446	1475.16	513	3016.91
1 in 40	418	1382.04	481	2828.96
1 in 45	395	1306.56	454	2670.23
1 in 50	375	1240.68	432	2539.18
1 in 60	343	1135.18	395	2322.04
1 in 70	317	1049.06	366	2151.30
1 in 80	296	979.43	342	2010.53
1 in 90	279	923.27	322	1892.96
1 in 100	264	873.85	306	1798.52

PART FOUR.

SANITARY LAW.

CHAPTER I.

SANITARY LAW.

"The broad general principle upon which all modern sanitary legislation rests is that every member of the community is entitled to protection in regard to his health, just as he is in regard to his liberty and property, and that on the other hand his liberty and his control of his property are only guaranteed to him on the condition that they shall be so exercised as not to interfere with the similar rights of others, nor be injurious to the community at large."—Dr. J. S. Billings in his introduction to Buck's "Hygiene and Public Health."

Sanitary law is based upon the police power of the State. Sanitary supervision is one of the essential functions of organized society. The very existence of society depends upon the prevention of disease and the preservation of the health of its members, and as this cannot possibly be attained by the efforts of the individual alone, it follows that it is the duty and province of the social organization, or the State, to guard the health

of the community by legislative enactments and general sanitary supervision.

Through ignorance, indolence, egotism, criminal negligence, or indifference to the rights and health of others, individuals may commit such acts, or let such acts be committed and such conditions prevail as may become a public nuisance, detrimental to the health and dangerous to the lives of their fellow men; it is then the right and duty of the State to step in and compel general obedience to the laws for the prevention of public nuisances and dangers to the public health.

Moreover, there are certain phases of social life that are the offspring of communal organization, such as the drainage of unhealthy areas, the water-supply of urban populations, the quarantine against infectious diseases, etc., which naturally come under the general sanitary control of the State, and which demand certain legislation for their supervision.

Hence, sanitary law is as old as society, and sanitary legislation can be traced back to the dawn of history, far back into the remotest times of antiquity, as we can see from the wise sanitary legislation of Moses, Solon, and Licurgus and of the great Roman sanitarians.

The essential difference, however, between the sanitary laws of those great law-givers and the legislation of to-day, is that the laws of the ancient legislators were but compulsory enactments of individuals, or small parts of the community, while the laws of to-day are based upon the scientific knowledge which is the property of all, and upon the general consent of all the people, whose direct representatives the legislators are.

Especially is this the case in the United States, with its enlightened representative government; here sanitary law truly rests upon the soundest foundation, that of the general welfare of the whole people.

Owing to the State organization of the United States, there is no uniformity in sanitary legislation as there is on the Continent, or in England; and we have here Federal, State, County and Municipal sanitary laws, at times one conflicting with another.

With the establishment of boards of health in every State of the Union, great progress has been made toward a uniformity in sanitary legislation and organization, and it is to be hoped that the establishment of a national board of health will, in the near future, culminate in the enactment of a general, uniform and all-embracing national sanitary law.

CHAPTER II.

SANITARY ORGANIZATION.

There are three forms of sanitary organization in the United States; State, County, and Municipal.

All the States of the Union, except Georgia, Idaho, Montana, Oregon, and Wyoming, have State organizations in sanitary matters, in the form of State boards of health. (Chapin.) The following States were the first to establish State boards of health: Louisiana in 1855; Massachusetts in 1869; California in 1870. (S. W. Abbott.)

The following States have county sanitary organizations: Alabama, California, Colorado, Connecticut, Delaware, Idaho, Indiana, Kentucky, Kansas, Louisiana, Maryland, Mississippi, Montana, North Carolina, North Dakota, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, and Wyoming. (Chapin.)

Most towns, cities, and municipalities in the Union are empowered by the States to have some form of sanitary organization, usually a board of health having complete supervision over all sanitary matters in the locality. As a rule, the municipal boards of health are independent of any State interference, although they get

their powers from the State. The State boards of health have, as a rule, an advisory function, their executive function, if they have any, being limited to supervision of river pollution, food adulteration, dairy products, etc.

The local municipal boards of health have, not only executive powers, but under the laws of the State, or by special charters, these boards of health have also legislative powers. The result of the legislative powers being delegated by the State to municipal boards of health is seen in the various sanitary codes of the municipalities, some of these being extensive and far-reaching.

The sanitary matters which come directly under the jurisdiction of the municipal boards of health are as follows: Water-supply, sewerage, street-cleaning, building and construction, plumbing, local and specific nuisances, supervision of foods, meat, milk, etc.; control of infectious diseases; school, factory, tenement-house and other inspections. In large cities the enumerated sanitary divisions are separated and given into the control of other departments than the boards of health proper. Thus, in New York City, owing to the vast proportion of the municipality and the complexity of sanitary work, there are special municipal departments on water-supply, sewers, buildings, tenement-houses, etc.

The organization of a special department having charge of tenement-houses exclusively is a new departure in sanitary organization, and is due to the special conditions prevailing in New York City, with its 45,000 tenement-houses.

Sanitary legislation in New York is in many respects far in advance of that in other cities, many of the sanitary laws of New York serving as models for other municipalities.

The following extracts, therefore, from the "Tenement-house Law," the organization of the "Tenement-house Departments," the "Plumbing Regulations," as well as the practice on "Disinfection," "Milk and School Inspection," will be of interest to students in Sanitation.

I.

TENEMENT-HOUSE LAW.

ENACTED BY THE LEGISLATURE OF THE STATE OF NEW YORK, 1901.

Chapter 334 of the Laws of the State of New York for 1901.

CHAPTER I.

DEFINITIONS.

Sec. 1. **Short title and application.** This act may be cited as the Tenement-house Act, and its provisions shall apply to cities of the first-class.

Sec. 2. **Definitions.** Certain words used in this act are defined for the purposes thereof as follows:

(1) A tenement-house is any house or building, or portion thereof, which is rented, leased, let or hired out, to be occupied, or is occupied as the home or residence of three families or more living independently of each other, and doing their cooking upon the premises, or by more than two families upon any floor, so living and cooking, but having a common right in the halls, stairways, yards, water-closets or privies, or some of them.

(2) A yard is an open unoccupied space on the same lot with a tenement-house, between the extreme rear line of the house and the rear line of the lot.

(3) A court is an open unoccupied space, other than a yard, on the same lot with a tenement-house. A court not extending to the street or yard is an inner court. A court extending to the street or yard is an outer court. If it extends to the street it is a street court. If it extends to the yard it is a yard court.

(4) A shaft includes exterior and interior shafts, whether for air, light, elevator, dumb-waiter, or any other purpose. A vent-shaft is one used solely to ventilate or light a water-closet compartment or bathroom.

(5) A public hall is a hall, corridor or passageway not within an apartment.

(6) A stair hall includes the stairs, stair landings and those portions of the public halls through which it is necessary to pass in going between the entrance floor and the roof.

(7) A basement is a story partly but not more than one-half below the level of the curb.

(8) A cellar is a story more than one-half below the level of the curb.

(9) A fireproof tenement-house is one the walls of which are constructed of brick, stone, iron or other hard incombustible material, and in which there are no wood beams or lintels, and in which the floors, roofs, stair halls and public halls are built entirely of brick, stone, iron or other hard incombustible material, and in which no woodwork or other inflammable material is used in any of the partitions, furrings or ceilings. But this definition shall not be construed as prohibiting, elsewhere than in the stair halls or entrance halls, the use of wooden flooring on top of the fireproof floors, or the use of wooden sleepers, nor as prohibiting wooden handrails and hard-wood treads such as described in section eighteen of this act.

(10) The word shall is always mandatory, and not directory, and denotes that the house shall be maintained in all respects according to the mandate, as long as it continues to be a tenement-house.

(11) Wherever the words, charter, ordinances, regulations, department of buildings, department of health, department of water-supply, fire department, corporation counsel, city treasury or fire limits occur in this act, they shall be construed as if followed by the words "of the city in which the tenement-house is situated."

Sec. 3. **Buildings converted or altered.** A building not erected for use as a tenement-house, if hereafter converted or altered to such use, shall thereupon become subject to all the provisions of this act affecting tenement-houses hereafter erected.

Sec. 4. **Buildings in process of erection.** A tenement-house not now completed, but the excavation for which shall have been commenced in good faith on or before the first day of June, nineteen hundred and one, after approval of the plans therefor by the department of buildings and the first tier of beams of which shall have been set on or before the first day of August, nineteen hundred

and one, shall be subject only to the provisions of this act affecting now-existing tenement-houses; provided, that the plans for the said house were filed in said department on or before the tenth day of April, nineteen hundred and one, and were in accordance with the laws in force at the time of filing, and that the building is built in accordance with such laws.

Sec. 5. **Corner lots.** When a lot is situated at a corner of two streets, if it has more frontage upon one street than the other, the lesser frontage shall be deemed the width and the greater frontage the depth of the lot within the meaning of this act; and when the width is greater than twenty-five feet, the excess over said twenty-five feet shall not be deemed part of a corner lot, but shall be subject to the provisions of this act in relation to lots other than corner lots.

CHAPTER II.

PROTECTION FROM FIRE.

TITLE I.

Provisions Applicable Only to Tenement-houses Hereafter Erected.

Sec. 11. **Fireproof tenements, when required.** Every tenement-house hereafter erected exceeding fifty-seven feet, or exceeding five stories or parts of stories, in height above the curb level, shall be a fireproof tenement-house, nor shall any tenement-house be altered so as to exceed such height without being made a fireproof tenement-house; provided, that this section shall not apply to a building of a height not exceeding sixty-seven feet, and not exceeding six stories or parts of stories in height above the curb level if such building shall have a frontage exceeding forty feet. A cellar is not a story within the meaning of this section.

Sec. 12. **Fire-escapes.** Every non-fireproof tenement-house hereafter erected, unless provided with fireproof outside stairways directly accessible to each apartment, shall have fire-escapes located and constructed as in this section required, except that tenement-houses that are less than four stories in height and which also do not contain accommodations for more than four families in all, may be equipped with such other iron, steel, or wire cable fire-escapes as may be approved by the department of buildings, such escapes must be capable of sustaining two thou-

sand pounds, and be of sufficient length to reach from the top floor to the ground, and with rungs not more than twelve inches apart and not less than fifteen inches in length.

(1) The fire-escapes shall be located both on the front and rear of the building at each story above the ground floor, and where there is an apartment not containing any room fronting on either the street or yard, an additional fire-escape shall be provided for such apartment. Where, however, there are not more than four rooms in a line comprising part of one apartment, and the apartment extends from the street to the yard, the rear fire-escape may be omitted. Fire-escapes may project into the public highway to a distance not greater than four feet beyond the building line.

(2) The fire-escapes shall consist of outside open iron balconies and stairways. The stairways shall be placed at an angle of not more than sixty degrees, with steps not less than six inches in width and twenty inches in length, and with a rise of not more than nine inches. The balcony on the top floor, except in case of a front fire-escape, shall be provided with a goose-neck ladder leading from said balcony to and above the roof.

(3) **Balconies.** The balconies shall not be less than three feet in width, taking in at least one window of each apartment at each story above the ground floor. They shall be below and not more than one foot below the window sills, and extend in front of and not less than nine inches beyond each window. There shall be a landing not less than twenty-four inches square at the head and foot of each stairway. The stairway opening on each platform shall be of a size sufficient to provide clear headway.

(4) **Floors of balconies.** The floors of balconies shall be of wrought iron or steel slats not less than one and a half inches by three-eighths of an inch, placed not more than one and one-quarter inches apart, and well secured and riveted to iron battens one and a half inches by three-eighths of an inch, nor over three feet apart and riveted at the intersection. The openings for stairways in all buildings shall not be less than twenty-one inches wide and thirty-six inches long, and such openings shall have no covers of any kind. The platforms or balconies shall be constructed and erected to safely sustain in all their parts a safe load at a ratio of four to one, of not less than eighty pounds per square foot of surface.

(5) **Railings.** The outside top rail shall extend around the entire length of the platform and in all cases shall go through the wall at each end, and be properly secured by nuts and four-inch square washers at least three-eighths of an inch thick, and no top rail shall be connected at angles by cast iron. The top rail of balconies shall be one and three-quarter inches by one-half inch of wrought iron, or one and a half inch angle iron one-quarter inch thick. The bottom rails shall be one and one-half inches by three-eighths of an inch wrought iron, or one and a half inch angle iron, one-quarter inch thick, well leaded into the wall. The standards or filling-in bars shall not be less than one-half inch round or square wrought iron, well riveted to the top and bottom rails and platform frame. Such standards or filling-in bars shall be securely braced by outside brackets at suitable intervals, and shall be placed not more than six inches from centres; the height of railings shall in no case be less than two feet nine inches.

(6) **Stairways.** The stairways shall be constructed and erected to fully sustain in all their parts a safe load at a ratio of four to one of not less than one hundred pounds per step, with the exception of the tread, which must safely sustain at said ratio a load of two hundred pounds. The treads shall be flat open treads not less than six inches wide and with a rise of not more than nine inches. The stairs shall be not less than twenty inches wide The strings shall not be less than three-inch channels of iron or steel, or other shape equally strong, and shall rest upon and be fastened to a bracket, which shall be fastened through the wall as hereinafter provided. The strings shall be securely fastened to the balcony at the top, and the steps in all cases shall be double-riveted or bolted to the strings. The stairs shall have three-quarter inch handrails of wrought iron, well braced.

(7) **Brackets.** The brackets shall not be less than one-half inch by one and three-quarter inches wrought iron placed edgewise, or one and three-quarter inch angle iron, one-quarter inch thick, well braced; they shall not be more than four feet apart, and shall be braced by means of not less than three-quarters of an inch square wrought iron, and shall extend two-thirds of the width of the respective balconies or brackets. The brackets shall go through the wall and be turned down three inches, or be properly secured by nuts and four-inch square washers at least three-

eighths of an inch thick. On new buildings the brackets shall be set as the walls are being built. When brackets are put on tenement-houses already erected, the part going through the wall shall not be less than one inch in diameter with screw nuts and washers not less than five inches square and one-half an inch thick.

(8) **Drop-ladders.** A proper drop-ladder shall be required from the lower balcony when the floor of such balcony is more than fourteen feet above the sidewalk or ground.

(9) **Painting.** All the parts of such fire-escapes shall receive not less than two coats of paint, one in the shop and one after erection. All fire-escape balconies shall contain a plate firmly fastened to the standards or filling-in bars near the top railing in front of each window, such plate to contain in plain, large, prominent, raised letters, each letter to be not less than one-half an inch in length, the following words: "Any one placing any encumbrance on this balcony will be fined ten dollars."

(13) **Bulkheads.** Every tenement-house hereafter erected shall have in the roof a fireproof bulkhead with a fireproof door to the same, and shall have fireproof stairs with a guide or hand-rail leading to the roof, and such stairs shall be kept free from encumbrance at all times. No bulkhead door shall at any time be locked with a key, but it may be fastened on the inside by movable bolts or hooks.

Sec. 14. **Stairs and public halls.** Every tenement-house hereafter erected shall have at least one flight of stairs extending from the entrance floor to the roof, and the stairs and public halls therein shall each be at least three feet wide in the clear.

Sec. 15. **Stairways in non-fireproof buildings.** Every non-fireproof tenement-house hereafter erected containing over eighty rooms shall also have an additional flight of stairs for every additional eighty rooms or fraction thereof; if said house contains not more than one hundred and twenty rooms, in lieu of an additional stairway the stairs and public halls throughout the entire building may each be at least one-half wider than is specified in sections fourteen and twenty of this act.

Sec. 16. **Stairways in fireproof buildings.** Every fireproof tenement-house hereafter erected containing over one hundred and twenty rooms shall have an additional flight of stairs for every additional one hundred and twenty rooms or fraction thereof; but if said house contains not more than one hundred and eighty

rooms, in lieu of an additional stairway the stairs and public halls throughout the entire building may each be at least one-half wider than is specified in sections fourteen and twenty of this act; and a power passenger elevator, enclosed in a separate shaft from the stairs, and distant not less than thirty-five feet from the main flight of stairs, shall be deemed the equivalent of an additional flight.

Sec. 17. Each flight of stairs mentioned in the last three sections shall have an entrance on the entrance floor from the street or street court, or from an inner court which connects directly with the street. All stairs shall be constructed with a rise of not more than seven and one-half inches and with treads not less than ten inches wide and not less than three feet long in the clear. Where winders are used, all treads at a point eighteen inches from the strings on the well side shall be at least ten inches wide.

Sec. 18. **Stair halls.** The stair halls in all non-fireproof as well as fireproof tenement-houses hereafter erected shall be constructed of fireproof material throughout, except as in this section specified. The risers, strings and banisters shall be of metal or stone. The treads shall be of metal, slate or stone, or of hard wood not less than two inches thick. Wooden hand rails to stairs will be permitted if constructed of hard wood. The floors of all stair halls shall be constructed of iron or steel beams and fireproof filling, and no non-fireproof flooring or sleepers shall be permitted. All windows on stair halls opening on courts shall be of good quality wire-glass in frames of fireproof material.

Sec. 19. In every non-fireproof tenement-house hereafter erected all stair halls shall be enclosed on all sides with brick walls. The doors opening from stair halls shall be fireproof and self-closing, and if provided with glass such glass shall be good quality wire-glass. There shall be no transom or movable sash opening from a stair hall to any other part of the house. Except on the entrance floor, each stair hall shall be shut off from all non-fireproof portions of the public halls and from all other non-fireproof parts of the building, on each story, by self-closing fireproof doors, and if glass is used in such doors it shall be of good quality wire-glass.

Sec. 20. **Entrance halls.** Every entrance hall in a tenement-house hereafter erected shall be at least three feet six inches wide

in the clear, from the entrance up to and including the stair enclosure, and beyond this point at least three feet wide in the clear. It shall be enclosed with brick walls, and shall comply with all the conditions of the preceding sections of this act as to the construction of stair halls. If such entrance hall is the only entrance to more than one flight of stairs, said hall shall be increased one foot in width in every part for each such additional flight of stairs. In every such house, access shall be had from the street to the yard, either in a direct line or through a court.

Sec. 21. **First tier of beams.** In all non-fireproof as well as fireproof tenement-houses hereafter erected five stories or more in height, exclusive of the cellar, the first floor above the cellar, or, if there be no cellar, above the lowest story, shall be constructed fireproof with iron or steel beams and fireproof flooring; and the bottom flanges and all exposed portions of such iron or steel beams below the abutments of the floor arches or filling shall be entirely encased with hard-burnt clay or porous terra cotta, or with metal lath properly secured and plastered on the under side. In all non-fireproof tenement-houses hereafter erected less than five stories in height, where the first floor above the cellar, or, if there be no cellar, above the lowest story, is not constructed fireproof with iron or steel beams and fireproof flooring, the cellar ceiling of said tenement-house shall be lathed with wire or metal lath and plastered thereon with two coats of brown mortar of good materials, or shall be covered with plaster boards not less than one-half inch in thickness, made of plaster and strong fibre, and all joints made true and well-pointed.

Sec. 22. **Partitions, Construction of.** In all non-fireproof tenement-houses hereafter erected, fore-and-aft stud partitions which rest directly over each other shall run through the wooden floor beams and rest upon the plate of the partition below, and shall have the studding filled in solid between the uprights to the depth of the floor beams with suitable incombustible materials. In all fireproof tenement-houses hereafter erected, all partitions shall rest directly upon the fireproof floor construction, and extend to the fireproof beam filling above.

Sec. 23. **Cellar stairs in non-fireproof buildings.** In non-fireproof tenement-houses hereafter erected there shall be no inside stairs communicating between the cellar or other lowest story and the floor next above, but such stairs shall in every case be

located outside the building, and if enclosed shall be constructed entirely fireproof and be enclosed in a fireproof enclosure with fireproof self-closing doors at all openings.

Sec. 24. **Cellar stairs in fireproof buildings.** In every fireproof tenement-house hereafter erected the stairs communicating between the cellar and other lowest story and the floor next above, if not located underneath the stairs leading to the upper stories, may be placed inside of the said building; provided, that the portion of the cellar or other lowest story into which said stairs lead is entirely shut off by fireproof walls from those portions thereof which are used for the storage of fuel, or in which heating appliances, boilers or machinery are located. All openings in such walls shall be provided with self-closing fireproof doors.

Sec. 25. **Closet under first-story stairs.** In non-fireproof tenement-houses hereafter erected no closet of any kind shall be constructed under any staircase leading from the first story, exclusive of the cellar, to the upper stories, but such space shall be left entirely open and kept clear and free from encumbrance.

Sec. 26. **Cellar entrance.** In every tenement-house hereafter erected there shall be an entrance to the cellar or other lowest story from the outside of the said building. In such tenement-houses, unless the entire ceiling and floor above the cellar or other lowest story is constructed fireproof, all receptacles for fuel or storage in the cellar or other lowest story shall be constructed entirely of fireproof materials.

Sec. 27. **Fire-stops.** In tenement-houses hereafter erected, in all walls all the courses of brick from the under side of the floor beams to the top of the same shall project a distance of at least two inches beyond the inside face of the wall, so as to provide an effective fire-stop; and wherever floor beams run parallel to a wall such beams shall always be kept at least two and one-half inches away from the inside line of the wall, and the space between the beams and the wall shall be built up solidly with brick-work from the under side of the floor beams to the top of the same, so as to form an effective fire-stop.

Sec. 28. **Wooden tenement-houses.** Within the fire limits no wooden tenement-house shall hereafter be erected, and no wooden building not now used as a tenement-house shall hereafter be altered or converted to such use. Outside of the fire limits, wooden tenement-houses not exceeding two stories in height, exclusive of

the cellar, may be erected, but shall not provide accommodations for, or be occupied by, more than four families in all, or more than two families on any floor; and such houses need not comply with the foregoing provisions of this act in reference to protection from fire nor with the provisions of sections twenty-nine, thirty, thirty-one, thirty-two, thirty-six, thirty-seven and thirty-eight of this act.

Title II.

Provisions Applicable Only to Now-existing Tenement-houses.

Sec. 29. **Fire-escapes.** Every now-existing non-fireproof tenement-house, unless provided with fireproof outside stairways directly accessible to each apartment, shall have fire-escapes located and constructed as described in section twelve of this act. But a fire-escape now erected upon such house shall be deemed sufficient except as provided in the next two sections.

Sec. 30. In every now-existing non-fireproof tenement-house there shall be a separate fire-escape directly accessible to each department, exclusive of fire-escapes in air shafts and courts; and a party-wall fire-escape balcony on the rear of the building connecting with the window of an adjoining building shall be deemed a sufficient fire-escape only when the two buildings are completely separated by an unpieced fire-wall throughout their entire height and length. All wooden floor slats and floors in fire-escape balconies shall be replaced by proper iron slats or floors. No wooden balcony or wooden outside stairs shall be deemed part of a lawful fire-escape.

Sec. 31. Whenever a now-existing non-fireproof tenement-house is not provided with sufficient means of egress in case of fire, the department of buildings may order such additional fire-escapes or other means of egress as in its judgment may be necessary.

Sec. 32. **Scuttles, bulkheads and ladders.** Every now-existing tenement-house shall have in the roof a bulkhead or scuttle constructed as in this section required. No scuttle shall be less in size than two feet by three feet, and all scuttles shall be covered on the outside with metal and shall be provided with stationary iron ladders or stairs leading thereto and easily accessible to all tenants of the building and kept free from encumbrance, and all scuttles and ladders shall be kept so as to be ready for use at

all times. Every bulkhead hereafter constructed in a tenement-house shall be fireproof with a fireproof door to the same and shall have fireproof stairs with a guide or handrail leading to the roof, and such stairs shall be kept free from encumbrance at all times. No scuttle and no bulkhead door shall at any time be locked with a key, but either may be fastened on the inside by movable bolts or hooks.

Sec. 33. **Stair halls, public halls and entrance halls.** If any now-existing tenement-house shall be so altered as to increase the number of rooms therein by twenty per centum or more, or if such building is increased in height, the entire stair halls, entrance halls and other public halls of the whole building shall be made to conform to the requirements of sections fourteen to twenty, inclusive, of this act.

Sec. 34. **Tenements damaged by fire.** If any now-existing tenement-house shall hereafter be damaged by fire or otherwise to an amount greater than one-half of the value thereof, exclusive of the value of the foundation, such building shall not be repaired or rebuilt except in conformity with the foregoing provisions of this act for the construction of tenement-houses hereafter erected. If the stairs in any now-existing tenement-house shall be damaged by fire or otherwise, to an amount greater than one-half of the value thereof, the entire stairs in the said tenement-house shall be reconstructed in accordance with the provisions of this act for stairs in tenement-houses hereafter erected.

Title III.

Provisions Applicable to all Tenement-houses Hereafter Erected or Now Existing.

Sec. 35. **Fire-escapes.** All fire-escapes hereafter constructed upon tenement-houses shall be located and constructed as described in section twelve of this act. The owner of every tenement-house shall keep all the fire-escapes thereon in good order and repair, and whenever rusty shall have them properly painted with two coats of paint. No person shall at any time place any encumbrance of any kind before or upon any such fire-escape.

Sec. 36. **Stairways.** In every tenement-house all stairways shall be provided with proper banisters and railings and kept in good repair.

Sec. 37. **Shafts.** All shafts hereafter constructed in tenement-houses shall be constructed fireproof throughout, with fireproof self-closing doors at all openings, at each story, except window openings in vent-shafts; and, if they extend to the cellar, shall also be enclosed in the cellar with fireproof walls and fireproof self-closing doors at all openings. In no case shall any shaft be constructed of materials in which any inflammable material or substance enters into any of the component parts. But nothing in this section contained shall be so construed as to require such enclosures about elevators or dumb-waiters in the well-hole of stairs where the stairs themselves are enclosed in brick or stone walls, and are entirely constructed of fireproof materials as hereinbefore provided.

Sec. 38. **Plastering behind wainscoting.** When wainscoting is hereafter placed in any tenement-house, or any building in process of alteration into a tenement-house, the surface of the wall or partition behind such wainscoting shall be plastered down to the floor line, and any intervening space between said plastering and said wainscot shall be filled in solid with incombustible material.

Sec. 39. **Wooden buildings on same lot with a tenement-house.** No wooden building of any kind whatsoever shall hereafter be placed or built upon the same lot with a tenement-house within the fire limits.

Sec. 40. **Combustible materials.** No tenement-house, nor any part thereof, shall be used as a place of storage for any combustible article except under such conditions as may be prescribed by the fire department, under authority of a written permit issued by said department. No tenement-house, nor any part thereof, shall be used as a place of storage for any article dangerous to life or health, nor for the storage of feed, hay, straw, excelsior or cotton, nor for the storage or handling of rags.

Sec. 41. **Bakeries and fat-boiling.** No bakery and no place of business in which fat is boiled shall be maintained in any tenement-house which is not fireproof throughout, unless the ceiling and side walls of said bakery or of the said place where fat-boiling is done are made safe by fireproof materials around the same, and there shall be no openings either by door or window, dumb-waiter shafts or otherwise, between said bakery or said place where fat is boiled in any tenement-house and the other parts of the said building.

Sec. 42. **Other dangerous businesses.** All transoms and windows opening into halls from any portion of a tenement-house where paint, oil, spirituous liquors or drugs are stored for the purpose of sale or otherwise shall be glazed with wire-glass, or they shall be removed and closed up as solidly as the rest of the wall; and all doors leading into any such hall from such portion of said house shall be made fireproof.

CHAPTER III.

LIGHT AND VENTILATION.

Title I.

Provisions Applicable Only to Tenement-houses Hereafter Erected.

Sec. 51. **Percentage of lot occupied.** No tenement-house hereafter erected shall occupy more than ninety per centum of a corner lot, or more than seventy per centum of any other lot, the measurements in all cases to be taken at the ground level; provided, that the space occupied by fire-escapes of the size hereinbefore prescribed shall not be deemed a part of the lot occupied.

Sec. 52. **Height.** The height of no tenement-house hereafter erected shall by more than one-third exceed the width of the widest street upon which it stands. Such height shall be the perpendicular distance measured in a straight line from the curb level to the highest point of the building exclusive of cornices and bulkheads, provided such bulkheads are not more than eight feet high and do not exceed in area ten per centum of the area of the roof; the measurements in all cases shall be taken through the centre of the facade of the house.

Sec. 53. **Yards.** Behind every tenement-house hereafter erected there shall be a yard extending across the entire width of the lot and at every point open from the ground to the sky unobstructed, except that fire-escapes or unenclosed outside stairs may project not over three feet from the rear line of the house. The depth of said yard, measured from the extreme rear wall of the house to rear line of the lot, shall be as set forth in the two following sections.

Sec. 54. **Yards of interior lots.** Except upon a corner lot the

depth of the yard behind every tenement-house hereafter erected sixty feet in height shall be not less than twelve feet in every part. Said yard shall be increased in depth one foot for every additional twelve feet of height of the building, or fraction thereof; and may be decreased in depth one foot for every twelve feet of height of the building less than sixty feet; but it shall never be less than ten feet in depth in any part.

Sec. 55. **Yards of corner lots.** The depth of the yard behind every tenement-house hereafter erected upon a corner lot shall be not less than ten feet in every part.

Sec. 56. **Yard spaces of lots running through from street to street.** Wherever a tenement-house hereafter erected is upon a lot which runs through from one street to another street, and said lot is not less than seventy feet nor more than one hundred feet in depth, there shall be a yard space through the centre of the lot midway between the two streets, which space shall extend across the full width of the lot and shall never be less than twelve feet in depth from wall to wall; but where the ground floor of such building is used or intended to be used as a store, such yard space may start at the second tier of beams. Where such lot is over one hundred feet in depth, such yard space shall conform to the provisions of section sixty-two of this act for inner courts, and shall be left through the centre of the lot midway between the two streets.

Sec. 57. **Courts.** No court of a tenement-house hereafter erected shall be covered by a roof or skylight, but every such court shall be at every point open from the ground to the sky unobstructed, and shall conform to the requirements of the following sections; provided, that an apartment not containing any room fronting upon the street or yard may have a fire-escape in a court, projecting not more than three feet from the wall of the house.

Sec. 58. **Outer Courts.** Where one side of an outer court is situated on the lot line, the width of the said court, measured from the lot line to the opposite wall of the building, for tenement-houses sixty feet in height, shall not be less than six feet in any part; and for every twelve feet of increase or fraction thereof in height of the said building, such width shall be increased six inches throughout the entire height of said court; and for every twelve feet of decrease in the height of the said building below sixty feet, such width may be decreased six inches, but

no such court shall be less than four feet six inches wide in any part.

Sec. 59. Where an outer court is situated between wings or parts of the same building, or between different buildings on the same lot, the width of the said court, measured from wall to wall, for tenement-houses sixty feet in height, shall not be less than twelve feet in any part; and for every twelve feet of increase or fraction thereof in the height of the said building, such width shall be increased one foot throughout the entire height of the said court; and for every twelve feet of decrease in the height of the said building below sixty feet, such width of the said court may be decreased one foot, but no such court shall ever be less than nine feet in width in any part.

Sec. 60. Wherever an outer court changes its initial horizontal direction, or wherever any part of such court extends in a direction so as not to receive direct light from the street or yard, the length of such portion of said court shall never exceed the width of said portion; such length to be measured from the point at which the change of direction commences. Wherever an outer court is less in depth than the minimum width prescribed by this section, then its width may be equal to, but not less than its depth, provided that such width is never less than four feet in the clear. This exception shall also apply to each offset or recess in outer courts. And no window except windows of water-closet compartments, bathrooms or halls shall open upon any offset or recess less than six feet in its least dimension.

Sec. 61. **Inner Courts.** Where one side of an inner court is situated on the lot line, the width of the said court measured from the lot line to the opposite wall of the building, for tenement-houses sixty feet in height, shall not be less than twelve feet in any part, and its other horizontal dimensions shall not be less than twenty-four feet in any part; and for every twelve feet of increase or fraction thereof in the height of the said building, such width shall be increased six inches throughout the entire height of said court, and the other horizontal dimensions shall be increased one foot throughout the entire height of said court; and for every twelve feet of decrease in the height of the said building below sixty feet, such width may be decreased six inches and the other horizontal dimension may be decreased one foot, but no such court shall be less than ten and a half feet in width in any

part, nor less than twenty-one feet in its other horizontal dimension.

Sec. 62. Where an inner court is not situated upon the lot line, but is enclosed on all four sides, the least horizontal dimension of the said court, for tenement-houses sixty feet in height, shall not be less than twenty-four feet; and for every twelve feet of increase or fraction thereof in the height of the said building, the said court shall be increased one foot in each horizontal dimension, throughout the entire height of said court; and for every twelve feet of decrease in the height of the said building below sixty feet, the horizontal dimensions of the said court may be decreased one foot in each direction, but no such court shall ever be less than twenty-one feet in its last horizontal dimension. Offsets or recesses in inner courts will be permitted, but where the depth of such offset or recess is less than the minimum width prescribed, then the width of said offset or recess may be equal to but not less than its depth, provided that such width is never less than four feet in the clear. And no window except windows of water-closet compartments, bathrooms or halls shall open upon any offset or recess less than six feet in its least dimension.

Sec. 63. Every inner court shall be provided with one or more horizontal intakes or ducts at the bottom. Said intake or ducts shall be not less in total area than four per centum of the area of said inner court. Each such intake or duct shall be at least five square feet in area, and shall always communicate directly with the street or yard. Whenever the said intakes or ducts consist of a passageway or passageways, such passageway shall be left open, or if not open there shall always be provided in said passageway or passageways open grilles or transoms of a size not less than five square feet each, and such open grilles or transoms shall never be covered over by glass or in any other way. There shall be at least two such grilles or transoms in each such passageway, one at the inner court and the other at the street or yard, as the case may be.

Sec. 64. **Outer and inner courts.** Nothing contained in the foregoing sections concerning outer and inner courts shall be construed as preventing windows at the angles of said courts, provided that the running length of the wall containing such windows does not exceed six feet. In construing said sections the height of the

building is to be measured from the curb level to the top of the highest wall enclosing or forming such court.

Sec. 65. **Rear tenements.** No separate tenement-house shall hereafter be erected upon the rear of a lot fifty feet or less in width where there is a tenement-house on the front of the said lot, nor upon the front of any such lot upon the rear of which there is such a tenement-house.

Sec. 66. **Buildings on same lot with tenement-houses.** If any building is hereafter placed on the same lot with a tenement-house, the space between the said buildings shall always be of such size and arranged in such manner as is prescribed in section sixty-two of this act for inner courts; and no building of any kind shall be hereafter placed upon the same lot with a tenement-house so as to decrease the minimum size of courts or yards as hereinbefore prescribed. And if any tenement-house is hereafter erected upon any lot upon which there is already another building, it shall comply with all of the provisions of this act, and in addition the space between the said building and the said tenement-house shall be of such size and arranged in such manner as is prescribed in section sixty-two of this act for inner courts, the height of the highest building on the lot to regulate the dimensions.

Sec. 67. **Rooms, lighting and ventilation of.** In every tenement-house hereafter erected every room, except water-closet compartments and bathrooms, shall have at least one window opening directly upon the street or upon a yard or court.

Sec. 68. **Windows in rooms.** In every tenement-house hereafter erected the total window area in each room, except water-closet compartments and bathrooms, shall be at least one-tenth of the superficial area of the room, and the top at least of one window shall not be less than seven feet six inches above the floor, and the upper half of it shall be made so as to open the full width. No such window shall be less than twelve square feet in area between the stop beads.

Sec. 69. **Windows in water-closet compartments and bathrooms.** In every tenement-house hereafter erected the total window area in a water-closet compartment or bathroom shall not be less than three square feet in area for each, and no such window shall be less than one foot in width, measured between stop beads.

Sec. 70. **Rooms, size of.** In every tenement-house hereafter

erected all rooms, except water-closet compartments and bathrooms, shall be of the following minimum sizes: In each apartment there shall be at least one room containing not less than one hundred and twenty square feet of floor area, and each other room shall contain at least seventy square feet of floor area. Each room shall be in every part not less than nine feet high from the finished floor to the finished ceiling; provided that an attic room need be nine feet high in but one-half its area.

Sec. 71. **Alcoves.** In every tenement-house hereafter erected where any room adjoins another room, and has eighty per centum or more of one entire side open to the other room, and there is no door between, it shall be considered as part of the said room. Under other circumstances every alcove shall be deemed a separate room for all purposes within the meaning of this act.

Sec. 72. **Public halls.** In every tenement-house hereafter erected every public hall shall have at least one window opening directly upon the street or upon a yard or court. Either such window shall be at the end of said hall, with the plane of the window at right angles to the axis of said hall, or there shall be at least one window opening directly upon the street or upon a yard or court for every twenty feet in length or fraction thereof of said hall. In such halls recesses or returns the length of which does not exceed twice the width of the hall will be permitted without an additional window; but wherever the length of such recess or return exceeds twice the width of the hall, the above provision in reference to one window for every twenty feet of hallway shall be applied. Any part of a hall which is shut off from any other part of said hall by a door or doors shall be deemed a separate hall within the meaning of this section.

Sec. 73. **Windows for public halls, size of.** In every tenement-house hereafter erected one at least of the windows provided to light each public hall or part thereof shall be at least two feet six inches wide and five feet high, measured between stop beads.

Sec. 74. **Windows for stair halls, size of.** In every tenement-house hereafter erected the aggregate area of windows to light or ventilate stair halls shall be at least twenty-one square feet for each floor. There shall be provided for each story at least one of said windows, which shall be at least three feet wide and five feet high, measured between the stop beads.

Sec. 75. **Privacy.** In every apartment of three or more rooms

in a tenement-house hereafter erected, access to every living room and bedroom, and to at least one water-closet compartment, shall be had without passing through any bedroom.

Title II.

Provisions Applicable Only to Now-existing Tenement-houses.

Sec. 76. **Percentage of lot occupied.** No now-existing tenement-house shall hereafter be enlarged, or its lot be diminished, so that the house occupy more than ninety per centum of a corner lot, or more than seventy per centum of any other lot, the measurements in all cases to be taken at the ground level; provided, that the space occupied by fire-escapes of the size hereinbefore prescribed shall not be deemed a part of the lot occupied.

Sec. 77. **Yards.** No now-existing tenement-house shall hereafter be enlarged or its lot be diminished, so that the yard shall be less than five feet in depth when the building is on a corner lot, or less than twelve feet in depth in other cases, the measurements in all cases to be taken from the extreme rear wall of the building to the rear lot line and across the full width of the lot, and such yard shall be at every point open from the ground to the sky, except as provided in section fifty-three of this act.

Sec. 78. **Additional rooms and halls.** Any additional room or hall that is hereafter constructed or created in a now-existing tenement-house shall comply in all respects with the provisions of the foregoing sections of this chapter as to the size, arrangement, light and ventilation of rooms and halls in tenement-houses hereafter erected.

Sec. 79. **Rooms, lighting and ventilation of, continued.** No room in a now-existing tenement-house shall hereafter be occupied for living purposes unless it shall have a window upon the street, or upon a yard not less than five feet deep, or upon a court or shaft of not less than twenty-five square feet in area, open to the sky without roof or skylight, or unless such room has a sash window opening into an adjoining room in the same apartment which itself has a window opening on the street, or on a yard not less than five feet deep, said sash window having at least fifteen square feet of glazed surface, being at least three feet high and five feet wide between stop beads, and at least one-half thereof

being made to open readily. Furthermore, no room in a now-existing tenement-house which does not have a window opening directly upon the street or upon a yard not less than five feet deep or upon a court or shaft of not less than twenty-five square feet in area open to the sky without roof or skylight shall hereafter be occupied for living purposes unless such room contains at least sixty square feet of floor area, and also at least six hundred cubic feet of air space; and no such room shall be so occupied unless there is six hundred cubic feet of air to each individual occupying the same. No such room shall be occupied unless it be in every part not less than eight feet high from the finished floor to the finished ceiling; provided, that an attic room need be eight feet high in but half its area.

Sec. 80. **Public halls, lighting of.** In every now-existing tenement-house four stories or over in height, whenever a public hall on any floor is not light enough in the daytime to permit a person to read in every part thereof without the aid of artificial light, the wooden panels in the doors located at the ends of the public halls and opening into rooms shall be removed, and ground glass or wire-glass panels of an aggregate of not less than four square feet for each door shall be substituted; or in lieu of removing the panels in the door a fixed window of wire-glass of an area of not less than five square feet may be cut into the partitions separating the said hall from a room which opens directly upon the street or upon a yard, court or shaft of the dimensions specified in the last section; or said public hall may be lighted by a window or windows at the end thereof with the plane of the window at right angles to the axis of the said hall, said window opening upon the street or upon a yard, court, or shaft of said dimensions.

Sec. 81. **Light and vent shafts in existing buildings.** Any sh used or intended to be used to light or ventilate rooms used or in tended to be used for living purposes, and which may be hereafter placed in a now-existing tenement-house, shall not be less in area than twenty-five square feet, not less than four feet in width in any part, and such shaft shall under no circumstances be roofed or covered over at the top with a roof or skylight; but if such shaft is provided at the bottom with a horizontal intake or duct, of a size not less than two square feet, and communicating directly with the street or yard, such shaft may be of a size not

less than three feet by five feet, provided that not more than two rooms on any floor open thereon, and that if it be used to light or ventilate any living room no water-closet open upon it.

TITLE III.

Provisions Applicable to all Tenement-houses Hereafter Erected or Now Existing.

Sec. 82. **Public halls.** In every tenement-house a proper light shall be kept burning by the owner in the public hallways, near the stairs, upon the entrance floor, and upon the second floor, above the entrance floor of said house, every night from sunset to sunrise throughout the year, and upon all other floors of the said house from sunset until 10 o'clock in the evening.

Sec. 83. **Skylights.** In every tenement-house there shall be in the roof directly over each stair-well, a ventilating skylight with both ridge ventilators and fixed louvres, the glazed surface thereof to be not less than twenty-five square feet in area.

Sec. 84. **Chimneys or fireplaces.** In every tenement-house there shall be adequate chimneys running through every floor with an open fireplace or grate, or place for a stove, properly connected with one of said chimneys for every apartment.

Sec. 85. **Vent shafts.** Every vent shaft hereafter constructed in a tenement-house shall be at least twenty square feet in area, and the least dimension of such shaft shall not be less than four feet; and if the building be above sixty feet in height, such shaft shall throughout its entire height be increased in area three square feet for each additional twelve feet of height or fraction thereof, and for each twelve feet of height less than sixty feet such shaft may be decreased in area three square feet. A vent shaft may be enclosed on all four sides, but shall not be roofed or covered over in any way. Every such shaft shall be provided with a horizontal intake or duct at the bottom, communicating with the street or yard, or with a court; such duct or intake to be not less than one and one-half square feet in total area.

CHAPTER IV.

SANITARY PROVISIONS.

TITLE I.

Provisions Applicable Only to Tenement-houses Hereafter Erected.

Sec. 91. **Basements and cellars.** In tenement-houses hereafter erected no room in the cellar shall be constructed, altered, converted or occupied for living purposes. And no room in the basement shall be constructed, altered, converted or occupied for living purposes, unless all of the following conditions are complied with:

1. Such room shall be at least nine feet high in every part from the floor to the ceiling.

2. The ceiling of such room shall be at least four feet and six inches above the surface of the street or ground outside of or adjoining the same.

3. There shall be appurtenant to such room the use of a separate water-closet, constructed and arranged as required by section ninety-five of this act.

4. Such room shall have a window or windows opening upon the street, or upon a yard or court. The total area of windows in such room shall be at least one-eighth of the superficial area of the room, and one-half of the sash shall be made to open the full width, and the top of each window shall be within six inches of the ceiling.

5. All walls surrounding such room shall be made damp-proof in the manner specified in the next section.

6. The floor of such room shall be made damp-proof and waterproof in the manner specified in the next section.

Sec. 92. **Basements and cellars, continued.** Every tenement house hereafter erected shall have all walls below the ground level and all cellar or lower floors made damp-proof and waterproof. Such damp-proofing and water-proofing shall run through the walls and up the same as high as the ground level and shall be continued throughout floor, and the said cellar or lowest floor shall be properly constructed so as to prevent dampness or water from entering.

Sec. 93. **Shafts, courts, areas and yards.** In every tenement-

house hereafter erected the bottom of all shafts, courts, areas and yards which extend to the basement for light or ventilation of living rooms, must be six inches below the floor level of the part occupied or intended to be occupied. All shafts, courts, areas and yards shall be properly concreted, graded and drained, and shall be properly connected with the street sewer so that all water may pass freely into it.

Sec. 94. **Water-supply.** In every tenement-house hereafter erected there shall be in each apartment a proper sink with running water.

Sec. 95. **Water-closet accommodations.** In every tenement-house hereafter erected there shall be a separate water-closet in a separate compartment within each apartment, provided that where there are apartments consisting of but one or two rooms, there shall be at least one water-closet for every three rooms. All water-closets compartments must have a window opening upon the street or yard or upon a court or vent shaft. Every water-closet compartment shall be provided with proper means of lighting the same at night. If fixtures for gas or electricity are not provided in said compartment, then the door of said compartment shall be provided with ground glass or wire-glass panels, or with a ground glass or wire-glass transom, not less in area than four square feet. The floor of every water-closet compartment shall be made waterproof with asphalt, cement, tile, stone, metal or some other water-proof material; and such water-proofing shall extend at least six inches above the floor so that the said floor can be washed or flushed out without leaking. No drip trays shall be permitted. No water-closet fixtures shall be enclosed with any woodwork.

Sec. 96. **Plumbing.** In every tenement-house hereafter erected all plumbing pipes shall wherever possible be exposed, or if such pipes are covered there shall be at each floor access to all rising lines through removable panels; said panels shall always be as wide as the whole stack of pipes and at least two feet and six inches in height.

Title II.

Provisions Applicable Only to Now-existing Tenement-houses.

Sec. 97. **Basements and cellars.** Hereafter in any now-existing tenement-house no room in the basement or cellar shall be occu-

pied for living purposes without a written permit from the department of health, and such permit shall be kept readily accessible in said room. And no such room shall hereafter be occupied unless all the following conditions are complied with:

1. Such room shall be at least eight feet high in every part from the floor to the ceiling.

2. The ceiling of such room shall be in every part at least two feet above the surface of the street or ground outside of or adjoining the same.

3. There shall be appurtenant to such room the use of a separate water-closet.

4. There shall be outside of and adjoining such room, and extending along the entire frontage thereof, an open space of at least two feet six inches wide in every part. The bottom of said space shall be at least six inches below the level of the floor of the room, and such space shall be well and effectually drained by a drain the bottom of which shall be at least one foot below the level of the floor of the room.

5. Such room shall have a window or windows opening to the outer air of at least nine feet square in size clear of the sash frame and at least four and one-half square feet of which shall have been made to readily open for purposes of ventilation.

6. If the house is situated over marshy ground, or ground on which water lies, or ground on which there is water pressure from below, the lowest floor shall have been made water-proof and damp-proof.

Sec. 98. **Water-closets.** In all now-existing tenement-houses the woodwork enclosing all water-closets shall be removed from the front of said closet, and the space underneath the seat shall be left open. The floor or other surface beneath and around the closet shall be maintained in good order and repair, and shall be kept well painted with white paint.

Sec. 99. **Public sinks.** In all now-existing tenement-houses the woodwork enclosing sinks located in the public halls or stairs shall be removed and the space underneath said sinks shall be left open. The floors and wall surfaces beneath and around the sink shall be maintained in good order and repair, and shall be kept well painted with white paint.

Sec. 100. **Privy vaults, school sinks and water-closets.** In all now-existing tenement-houses, all school sinks, privy vaults or other sim-

ilar receptacles, used to receive fecal matter, urine or sewage, shall before January first, nineteen hundred and three, be completely removed and the place where they were located properly disinfected under the direction of the department of health. Such appliances shall be replaced by individual water-closets of durable non-absorbent material, properly sewer connected, and with individual traps and properly connected flush tanks providing an ample flush of water to thoroughly cleanse the bowl. The seats of the water-closets shall be hinged and attached to the bowl of the closet. Each water-closet shall be located in a compartment completely separated from every other water-closet. The floors of the water-closet compartments shall be water-proof, as provided in section ninety-five of the act. Such water-closets may be located in the yard if necessary, and if so, long hopper closets may be used; all traps, flush tanks and pipes shall be protected against the action of frost. There shall be provided at least one water-closet for every two families in every now-existing tenement-house. Except as in this section otherwise provided, such water-closets and all plumbing in connection therewith shall be in accordance with the ordinances and regulations in relation to plumbing and drainage.

TITLE III.

Provisions Applicable to All Tenement-houses, Whether Hereafter Erected or Now Existing.

Sec. 101. **Basements and cellars.** The floor of the cellar or lowest floor of every tenement-house shall be water-tight, and the cellar ceilings shall be plastered.

Sec. 102. **Cellar walls and ceilings.** The cellar walls and ceilings of every tenement-house shall be thoroughly whitewashed or painted a light color by the owner at least once a year; and no tenement-house hereafter erected, whether or not it has now been actually commenced, shall be occupied until this has been done for the first time.

Sec. 103. **Roofs.** The roof of every tenement-house shall be kept in good repair and so as not to leak, and all rain water shall be so drained and conveyed therefrom as to prevent its dripping on to the ground or causing dampness in the walls, ceilings, yards or areas.

Sec. 104. **Water-supply.** Every tenement-house shall have water furnished in sufficient quantity at one or more places on each floor occupied by or intended to be occupied by one or more families. The owner shall provide proper and suitable tanks, pumps or o her appliances to receive and to distribute an adequate and sufficient supply of such water at each floor in the said house, at all times of the year, during all hours of the day and night. But a failure in the general supply of water by the city authorities shall not be construed to be a failure on the part of such owner, provided that proper and suitable appliances to receive and distribute such water have been provided in said house.

Sec. 105. **Cleanliness of buildings.** Every tenement-house and every part thereof shall be kept clean and free from any accumulation of dirt, filth or garbage, or other matter in or on the same, or in the yards, courts, passages, areas or alleys connected with or belonging to the same. The owner of every tenement-house or part thereof shall thoroughly cleanse all the rooms, passages, stairs, floors, windows, doors, walls, ceilings, privies, water-closets, cesspools, drains, halls, cellars, roofs and all other parts of the said tenement-house, or part of the house of which he is the owner, to the satisfaction of the department of health, and shall keep the said parts of the said tenement-house in a cleanly condition at all times No person shall place filth, urine or fecal matter in any place in a tenement-house other than that provided for the same, or keep filth, urine or fecal matter in his apartment or upon his premises such length of time as to create a nuisance.

Sec. 106. **Shafts and courts.** In every tenement-house there shall be, at the bottom of every shaft and inner court, a self-closing fireproof door giving sufficient success to such shaft or court to enable it to be properly cleaned out.

Sec. 107. **Walls of courts and shafts.** The walls of all yard courts, inner courts and shafts. unless built of a light color brick or stone, shall be thoroughly whitewashed by the owner at least once in three years, or shall be painted a light color by him at least once in five years; and no tenement-house hereafter erected, whether or not it has now been actually commenced, shall be occupied until this has been done for the first time.

Sec. 108. **Wall paper.** No wall paper shall be placed upon a wall or ceiling of any tenement-house unless all wall paper shall be first removed therefrom, and said wall and ceiling thoroughly cleaned.

Sec. 109. **Receptacles for ashes, garbage and refuse.** The owner of every tenement-house shall provide for said building proper and suitable conveniences or receptacles for ashes, rubbish, garbage, refuse and other matter.

Sec. 110. **Prohibited uses.** No horse, cow, calf, swine, sheep or goat shall be kept in a tenement-house, or on the premises thereof, and no tenement-house shall be used for a lodging-house or stable, or for the storage or handling of rags.

Sec. 111. **Janitor or housekeeper.** Whenever there shall be more than eight families living in any tenement-house, in which the owner thereof does not reside, there shall be a janitor, housekeeper or some other responsible person who shall reside in said house and have charge of the same, if the department of health shall so require.

Sec. 112. **Overcrowding.** No room in any tenement-house shall be so overcrowded that there shall be afforded less than four hundred cubic feet of air to each adult, and two hundred cubic feet of air to each child under twelve years of age occupying such room, and no apartment in any tenement-house shall be so overcrowded that there shall be afforded in the living rooms and bedrooms of said apartment less than six hundred cubic feet of air to each individual occupying such apartment.

Sec. 113. **Space around pipes.** In all tenement-houses, where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed or made air-tight with plaster, or other incombustible materials, so as to prevent the passage of air or the spread of fire from one floor to another, or from room to room.

CHAPTER V.

REMEDIES.

TITLE I.

General Powers and Duties.

Sec. 121. **Permit to commence building.** Before the construction or alteration of a tenement-house, or the alteration or conversion of a building for use as a tenement-house, is commenced, the owner, or his agent or architect, shall submit to the department charged with the enforcement of this act a detailed statement in writing, verified by the person making the same, of the specifications for the

construction and for the light and ventilation of such tenement-house or building, upon a blank or form to be furnished by such department, and also a full and complete copy of the plans of such work. Such statement shall give in full the name and residence, by street and number, of the owner or owners of such tenement-house or building. If such construction, alteration, or conversion, is proposed to be made by any other person than the owner of the land in fee, such statement shall contain the full name and residence, by street and number, not only of the owner of the land, but of every person interested in such tenement-house, either as owner, lessee or in any representative capacity. The statements herein provided for may be made by the owner, or the person who proposes to make the construction, alteration or conversion, or by his agent or architect. No person, however, shall be recognized as the agent of the owner, unless he shall file with the said department a written instrument, signed by such owner, designating him as such agent. Such specifications, plans and statements shall be filed in the said department and shall be deemed public records, but no such specifications, plans or statements shall be removed from said department. The said department shall cause all such plans and specifications to be examined. If such plans and specifications conform to the provisions of this act and to the building ordinances and regulations, they shall be approved by such department, and a written certificate to that effect shall be issued to the person submitting the same. The department may, from time to time, approve changes in any plans and specifications previously approved by it; provided the plans and specifications, when so changed, shall be in conformity with law. The construction, alteration or conversion of such tenement-house or building, or any part thereof, shall not be commenced until the filing of such specifications, plans and statements, and the approval thereof, as above provided.

Sec. 122. **Certificate of compliance.** No building hereafter constructed as or altered into a tenement-house shall be occupied in whole or in part for human habitation until the issuance of a certificate by the department aforesaid that said building conforms in all respects to the requirements of this act. Such certificate shall be issued within ten days after written application therefor, if said building at the date of such applications shall be entitled thereto.

Sec. 123. **Unlawful occupation.** If any building hereafter con-

structed as or altered into a tenement-house be occupied in whole or in part for human habitation in violation of the last section, during such unlawful occupation any bond or note secured by a mortgage upon said building, or the lot upon which it stands, may be declared due at the option of the mortgagee. No rent shall be recoverable by the owner or lessee of such premises for said period, and no action or special proceeding shall be maintained therefor, or for possession of said premises for non-payment of such rent. The department of water-supply shall not permit water to be furnished in any such tenement-house, and said premises shall be deemed unfit for human habitation, and the department of health shall cause them to be vacated accordingly.

Sec. 124. **Enforcement.** Except as herein otherwise provided, the provisions of this act shall be enforced by the department of any city to which this act applies, which is now charged with the enforcement of laws, ordinances and regulations relating to similar subject matter in tenement-houses.

Sec. 126. **Penalties for violations.** Every person who shall violate or assist in the violation of any provision of this act, shall be guilty of a misdemeanor punishable by imprisonment for ten days for each and every day that such violation shall continue, or by a fine of not less than ten dollars nor more than one hundred dollars if the offence be not wilful, or of two hundred and fifty dollars if the offence be wilful, and in every case of ten dollars for each day after the first that such violation shall continue, or by both such fine and imprisonment in the discretion of the court; provided that the punishment for a violation of section one hundred and thirty-one of this act shall be a fine of fifty dollars; and provided further that the penalty for encumbrance of a fire-escape by an occupant of the tenement-house shall be a fine of ten dollars, which the nearest police magistrate shall have jurisdiction to impose.

Sec. 127. **Violation of building laws, ordinances and regulations.** Any owner, agent, architect, builder, contractor, sub-contractor or foreman who shall, in the construction or alteration of any building intended to be used as a tenement-house, knowingly violate any of the provisions of the building laws, ordinances or regulations, shall be guilty of a misdemeanor.

Sec. 128. **Procedure.** Except as herein otherwise specified, the procedure for the prevention of violations of this act, or for the

vacation of premises unlawfully occupied, or for other abatement of nuisance in connection with a tenement-house, shall be as set forth in charter and ordinances.

Sec. 129. **Liens.** Every fine imposed by judgment under section one hundred and twenty-six of this act upon a tenement-house owner shall be a lien upon the house in relation to which the fine is imposed from the time of the filing of a certified copy of said judgment in the office of the clerk of the county in which said tenement-house is situated, subject only to taxes, assessments and water-rates, and to such mortgage and mechanics' liens as may exist thereon prior to such filing; and it shall be the duty of the department of health, upon the entry of said judgment, to forthwith file the copy as aforesaid, and such copy, upon such filing, shall be forthwith indexed by the clerk in the index of mechanics' liens.

TITLE II.

Registry of Names and Service of Papers.

Sec. 131. **Registry of owners' names.** Every owner of a tenement-house and every lessee of the whole house, or other persons having control of a tenement-house, shall file in the department of health a notice containing his name and address, and also a description of the property, by street number or otherwise, as the case may be, in such manner as will enable the department of health easily to find the same; and also the number of apartments in each house, the number of rooms in each apartment, the number of families occupying the apartments, and the trades or occupations carried on therein. In case of a transfer of any tenement-house, it shall be the duty of the grantor or grantee of said tenement-house to file in the department of health a notice of such transfer, stating the name of the new owner, within thirty days after such transfer. In case of the devolution of said property by will, it shall be the duty of the executor and the devisee, if more than twenty-one years of age, and in case of the devolution of such property by inheritance without a will, it shall be the duty of the guardians of such heirs, and in case said heirs have no guardians, it shall be the duty of the administrator of the deceased owner of said property to file in said department a notice, stating the death of the deceased owner, and the name of those who have succeeded to his interest in said property, within

thirty days after the death of the decedent, in case he died intestate, and within thirty days after the probate of his will, if he died testate.

Sec. 132. **Registry of agent's name.** Every owner, agent, or lessee of a tenement-house may file in the department of health a notice containing the name and address of an agent of such house, for the purpose of receiving service of process, and also a description of the property by street number or otherwise, as the case may be, in such manner as will enable the department of health easily to find the same. The name of the owner or lessee may be filed as agent for this purpose.

Sec. 133. **Service of notices and orders.** Every notice or order in relation to a tenement-house shall be served five days before the time for doing the thing in relation to which it shall have been issued. The posting of a copy of such notice or order in a conspicuous place in the tenement-house, together with the mailing of a copy thereof, on the same day that it is posted, to each person, if any, whose name has been filed with the department of health in accordance with the provisions of sections one hundred and thirty-one and one hundred and thirty-two of this act, at his address as therewith filed, shall be sufficient service thereof.

Sec. 134. **Service of summons.** In any action brought by any city department in relation to a tenement-house for injunction, vacation of the premises, or other abatement of nuisance, or to establish a lien thereon, it shall be sufficient service of the summons to serve the same as notices and orders are served under the provisions of the last section; provided, that if the address of any agent whose name and address have been filed in accordance with the provisions of section one hundred and thirty-two of this act is in the city in which the tenement-house is situated, then a copy of the summons shall also be delivered at such address to a person of proper age, if upon reasonable application admittance can be obtained and such person found; and provided also, that personal service of the summons upon the owner of such tenement-house shall be sufficient service thereof upon him.

Sec. 135. **Indexing names.** The names and addresses filed in accordance with sections one hundred and thirty-one and one hundred and thirty-two shall be indexed under direction of the registrar of records of the department of health, in such a manner that all of those filed in relation to each tenement-house shall

be together, and readily ascertainable. The board of health shall provide the registrar with the necessary books and clerical assistance for that purpose, and the expense thereof shall be paid by the city. Said indexes shall be public records, open to public inspection during business hours.

Title III.

Prostitution in Tenement-houses.

Sec. 141. **Vagrancy.** A woman who knowingly resides in or commits prostitution in a house of prostitution or assignation of any description in a tenement-house, or solicits any man or boy to enter therein for purposes of prostitution, shall be deemed a vagrant, and upon conviction thereof shall be committed to a county jail for a term not exceeding six months from the date of commitment. The procedure in such case shall be made the same as that provided by law for other cases of vagrancy.

Sec. 142. **Lien.** A tenement-house shall be subject to a penalty of one thousand dollars, if it or any part of it shall be used for the purpose of a house of prostitution or assignation of any description, with the permission of the owner thereof, or his agent, and said penalty shall be a lien upon the house and the lot upon which the house is situated.

Sec. 143. **Permission of lessee.** If a tenement-house, or any part thereof, shall be used for the purpose of a house of prostitution or assignation of any description with the permission of the lessee of the whole of said tenement-house, or his agent, the lease shall be terminable at the election of the lessor. And the owner shall be entitled to recover possession of said tenement-house by summary proceedings in the manner provided by title two of chapter seventeen of the code of civil procedure.

Sec. 144. **Permission of owner.** A tenement-house shall be deemed to have been used for the purpose specified in the last two sections with the permission of the owner and lessee thereof, if summary proceedings for the removal of the tenants of said tenement-house or of so much thereof as is unlawfully used, shall not have been commenced within five days after notice of such unlawful use, served by the department of health in the manner prescribed by law for the service of notices and orders in relation to tenement-houses.

II.

TENEMENT-HOUSE DEPARTMENT.

(Extract from New York City Charter.)

1. Organization of department; officers and employees.
2. Powers and duties of department.
3. Records and reports; miscellaneous provisions.

Organization of Department; Bureaus; Officers and Employees.

Sec. 1326. **Department created; tenement-house commissioner.** The head of the tenement-house department shall be called the tenement-house commissioner. He shall be appointed by the mayor, and shall hold office as provided in chapter four of this act. His salary shall be seven thousand five hundred dollars a year.

Sec. 1327. **Deputy commissioner.** The commissioner shall have power to appoint and, in his discretion, to remove not more than two deputies, to be known as first deputy, and second deputy, and shall define their duties. The first deputy shall during the absence or disability of the commissioner possess all the powers and perform all the duties of the commissioner except the power of making appointments. In the absence or disability of both the commissioner and the first deputy, the second deputy shall possess all the powers and perform all the duties of the commissioner, except the power of making appointments.

The salaries of such deputies shall be four thousand dollars a year each.

Sec. 1328. **Bureaus; divisions of department for Brooklyn, Queens and Richmond.** There shall be in the tenement-house department, (1) a new building bureau; (2) an inspection bureau; (3) a bureau of records; and such other bureaus as the commissioner may deem necessary.

A separate division of the department may be established in the borough of Brooklyn, with jurisdiction over tenement-houses in the borough of Brooklyn, and also in the discretion of the commissioner over tenement-houses in the boroughs of Queens or Richmond, or both. The commissioner may designate the deputy com-

missioner or some other officer of the department as the executive head of such division, who shall perform such duties and possess such powers as may be delegated to him by the commissioner. A branch of each of the bureaus above specified may be established in such division.

Sec. 1329. **Officers and employees.** The tenement-house commissioner, within the limits of his appropriation, shall have power to appoint and remove, subject to the requirements of the civil-service laws, such subordinate officers, assistants and employees as may be necessary for the efficient performance of his duties as said commissioner.

In the new building bureau there shall be no less than three plan examiners and not less than sixteen inspectors of light and ventilation. In the inspection bureau there shall be not less than one hundred and ninety inspectors, including such persons as may be detailed by the police commissioner for service in the tenement-house department. The commissioner shall appoint a chief inspector and deputy chief inspector over such bureau. In the other bureaus there shall be such registrars, clerks and employees as are necessary to perform the duties thereof.

All such officers and employees shall be subject to the supervision and control of the commissioner, and shall perform such duties as are assigned by him. Such commissioner may make regulations governing each such bureau, and branch thereof, not inconsistent with law.

Sec. 1330. **Duties of bureaus.** The new building bureau shall file, record and examine plans and specifications for the light and ventilation of tenement-houses hereafter altered or erected, and of buildings to be altered or reconstructed for use as tenement-houses. It shall inspect all such houses and buildings in the course of construction or alteration, and record all violations of the tenement-house act in respect thereto.

The inspection bureau shall inspect all completed tenement-houses, and record all violations of the tenement-house laws and ordinances. The commissioner shall prescribe the duties of the inspectors connected with such bureau, and may assign them to such part of the city as he may deem best.

The bureau of records shall contain records of every tenement-house in the city, to be kept in the manner and form prescribed by the commissioner.

Such other bureaus as may be organized by the commissioner shall perform the duties prescribed by him, and he may assign thereto such employees as may be necessary.

Sec. 1331. **Offices and expenses.** The commissioner may provide offices for the use of the department, its bureaus and the branches thereof. Such commissioner may, subject to the other provisions of this act, make such incidental and additional expenditures, having due regard to economy, as the purposes and provisions of this chapter may require. He may provide that the failure of an inspector, officer or employee of the department to properly perform his duty shall cause a forfeiture of the whole or any part of the salary or compensation of such inspector, officer or employee.

Sec. 1332. **Seal.** The commissioner may design and adopt a seal for the department, and cause the same to be used in the authentication of the orders and proceedings of the department, and for such other purposes as he may prescribe. The courts shall take judicial notice of such seal, and of the signature of the commissioner and deputy commissioner of such department.

Sec. 1333. **Annual report.** The commissioner shall make an annual report at some time prior to the first day of March of each year to the mayor of The City of New York of all the operations of his department for the year ending on the preceding thirty-first day of December. Such report shall, if ordered by the mayor, be published in the City Record, and shall also be published in book form for public information. The mayor may, at any time, call for a fuller report, or for a report upon any portion of the work of said department, whenever he deems it for the public good so to do.

Sec. 1334. **Publication of statistics and other data.** The commissioner may provide for the publicity of the papers, files, reports, records and the proceedings of his department, whenever he deems it necessary for the public good and public service. There shall be kept in such department statistics of all tenement-houses, which shall be contained in the annual report of such department.

Sec. 1335. **Uniforms and badges.** The commissioner may provide or designate a suitable uniform to be worn by inspectors. He may also provide a badge of metal, with a suitable inscription

thereon, and require it to be worn by the inspectors and officers of the department.

Sec. 1336. **Reports of inspectors.** Each of such inspectors shall report in writing, at least once in each week, to the commissioner. The form, manner and scope of such reports shall be prescribed by the commissioner. Such reports shall be filed in the department.

Sec. 1337. **Proofs, affidavits and oaths.** Proofs, affidavits and examinations as to any matter arising in connection with the performance of any of the duties of the tenement-house department may be taken by or before the tenement-house commissioner, or his deputy, or such other person as he may designate; and such commissioner, deputy or other person may administer oaths in connection therewith.

Sec. 1338. **Complaint book.** The commissioner shall cause to be kept in his department a general complaint book, or several such books, in which may be entered by any person any complaint in reference to tenement-houses, with the name and residence of the complainant, the name of the person complained of, the date of the entry of the complaint and suggestions of any proper remedy. Such book shall be open to public examination during the office hours of the department, subject to such regulations as the commissioner may prescribe. The tenement-house commissioner shall cause the facts in regard to all complaints to be investigated.

Sec. 1339. **Attorneys.** The corporation counsel shall assign to such department such assistant counsel as may be needful, in the manner provided by chapter seven of this act.

Powers and Duties of Department.

Sec. 1340. **General powers and duties.** All the rights and powers possessed by the health department of The City of New York with respect to the sanitary inspection of tenement-houses are hereby conferred upon the tenement-house department; and the tenement-house department is hereby charged with the duty of enforcing all the provisions of the tenement-house act, except that sections eleven to twenty-eight, inclusive, and sections thirty-three, thirty-four, thirty-seven, thirty-eight and thirty-nine of said act shall be enforced by the bureaus of buildings of their respective boroughs. The names of owners, lessees and agents, and persons having control of tenement-houses, shall be filed in, and

the taxpayers' request for the institution of an action for a lien upon a tenement-house shall be presented to, the tenement-house department instead of to the department of health. Nothing herein contained shall abrogate or impair the existing powers of the department of health of The City of New York. The tenement-house department shall have the powers and shall perform the duties specified in this chapter.

Sec. 1341. **Transfer of powers of other departments.** Such rights, powers and duties as are now possessed by the fire department and police department of The City of New York with respect to the prevention of encumbrance or obstruction of fire-escapes on tenement-houses are hereby transferred to and conferred upon the tenement-house department. All rights, powers and duties now possessed by the department of buildings and the department of health of The City of New York with respect to the light and ventilation of tenement-houses, and with respect to the equipment of completed tenement-houses with fire-escapes, are transferred to and conferred upon the tenement-house department.

Sec. 1342. **Approval of plans and specifications for light and ventilation.** Before the construction or alteration of a tenement-house, or the alteration or conversion of a building for use as a tenement-house, is commenced, the owner, or his agent or architect, shall submit to the tenement-house department a detailed statement in writing, verified by the person making the same, of the specifications for the light and ventilation of such tenement-house or building, upon a blank or form to be furnished by such department, and also a full and complete copy of the plans of such work. Such statement shall give in full the name and residence, by street and number, of the owner or owners of such tenement-house or building. If such construction, alteration, or conversion, is proposed to be made by any other person than the owner of the land in fee, such statement shall contain the full name and residence, by street and number, not only of the owner of the land, but of every person interested in such tenement-house, either as owner, lessee or in any representative capacity. The statements herein provided for may be made by the owner, or the person who proposes to make the construction, alteration or conversion, or by his agent or architect. No person, however, shall be recognized as the agent of the owner, unless he shall file with the tenement-house department a written instrument, signed by

such owner, designating him as such agent. Such specifications, plans and statements shall be filed in the office of the tenement-house department and shall be deemed public records, but no such specifications, plans or statements shall be removed from said department.

The commissioner shall cause all such plans and specifications to be examined. If such plans and specifications conform to the provisions of the tenement-house act, they shall be approved by such commissioner, and a written certificate to that effect shall be issued to the person submitting the same. The commissioner may, from time to time, approve changes in any plans and specifications previously approved by him, provided the plans and specifications when so changed shall be in conformity with law.

The construction, alteration or conversion of such tenement-house or building, or any part thereof, shall not be commenced until the filing of such specifications, plans and statements, and the approval thereof by the tenement-house commissioner, as above provided.

No permit shall be granted and no plan approved by the bureau of buildings of any borough of The City of New York for the construction or alteration of a tenement-house, or for the alteration or conversion of any building for use as a tenement-house, until there has been filed in such bureau of buildings a certificate of the tenement-house commissioner, issued as above provided.

Sec. 1343. **Inspection of tenement-houses in course of construction.** The commissioner shall cause an inspection and examination to be made of all tenement-houses in the course of construction or alteration, and also of all buildings in course of alteration or conversion for use as tenement-houses, for the purpose of ascertaining whether such tenement-houses or buildings are being constructed, altered and converted in conformity with the law, and the plans and specifications on file in the office of the department, and approved by the commissioner.

Sec. 1344. **Certificate of owner of tenement-house hereafter erected or altered.** No building hereafter constructed as or altered into a tenement-house shall be occupied in whole or in part for human habitation, until the issuance of a certificate by the tenement-house commissioner that said building conforms in all respects to the provisions of the tenement-house act not excepted in section thirteen hundred and forty of this act ; and of a certificate

by the superintendent of buildings of the borough in which the building is situated that the building conforms in all respects to the requirements of said excepted sections. Such certificates shall be issued within ten days after written application therefor, if said building at the date of such application shall be entitled thereto. If any building hereafter constructed as or altered into a tenement-house be occupied in whole or in part for human habitation without such certificates, during such unlawful occupation any bond or note secured by a mortgage upon said building, or the lot upon which it stands, may be declared due at the option of the mortgagee. No rent shall be recoverable by the owner or lessee of such premises for said period, and no action or special proceeding shall be maintained therefor, or for possession of said premises for non-payment of such rent. The department of water-supply shall not permit water to be furnished in any such tenement-house, and said premises shall be deemed unfit for human habitation, and the tenement-house commissioner shall cause them to be vacated accordingly.

Sec. 1344a. **Inspection of completed tenement-houses.** Except as hereinafter otherwise provided, the tenement-house commissioner shall cause an inspection of every completed tenement-house in the city to be made at least once in each month. Such inspection shall include examination of cellars, halls, water-closets, privies, plumbing, yards, areas, fire-escapes, roofs, shafts, courts, tanks and all other parts of such tenement-houses and the premises connected therewith. In tenement-houses where the average rental of the apartments therein is twenty-five dollars a month or more, such inspection may be made less often than once a month, as above provided, in the discretion of the tenement-house commissioner. The tenement-house commissioner shall prescribe the manner in which such inspections shall be made.

The inspectors shall immediately report to the tenement-house department all violations of the tenement-house act, and the tenement-house commissioner shall issue such orders as he may deem necessary requiring the removal of the defect or the cessation of the act which is in violation of such law.

Sec. 1344b. **Injunctions, when to be granted against the department.** No preliminary injunction shall be granted against the tenement-house department or its officers except by the supreme court, at a special term thereof, after service of at least five days' notice

of the motion for such injunction, together with copies of the papers upon which the motion for such injunction is to be made. Whenever such department shall seek any provisional remedy or shall prosecute an appeal, it shall not be necessary, before obtaining or prosecuting the same, to give an undertaking.

Sec. 1344c. **Power of attorney for the department.** The counsel assigned by the corporation counsel to the tenement-house department shall sue for and collect all penalties, and take charge of and conduct all legal proceedings imposed or provided by this chapter or by the tenement-house act, and all other tenement-house laws, regulations and ordinances. All suits or proceedings instituted for the enforcement of the several provisions of this chapter, or for the recovery of penalties imposed by the tenement-house act, shall be brought in the name of the tenement-house department of The City of New York, by such counsel. The penalties recovered shall be paid to such counsel. He shall, on the first of each month, render to the commissioner an itemized statement of all moneys collected by him, and pay over the same to the tenement-house commissioner. He shall at the same time render a statement of the necessary disbursements incurred or paid in the prosecution or the actions and proceedings instituted by him. The tenement-house commissioner shall pay monthly the amount of such moneys so collected to the comptroller of The City of New York.

Sec. 1344d. **No personal liability.** An officer or employee of the tenement-house department shall not be liable for acts done by him in good faith, in the performance of his official duties, pursuant to the direction of the commissioner or the rules and regulations of the department. Any person whose property has been unjustly or illegally destroyed or injured pursuant to the order, regulation or ordinance of such tenement-house department, or its officers or employees, for which no personal liability exists as aforesaid, may maintain a proper action against the city for the recovery of the proper compensation or damage. Every such suit shall be brought within six months after the cause of action arose, and the recovery shall be limited to the damages suffered.

Sec. 1344e. **Right of entry of officers of department.** The tenement-house commissioner and his deputies and all inspectors of the tenement-house department, and such other persons as are authorized by the commissioner, may without fee or hindrance enter, examine and survey all premises, grounds, erections, structures,

apartments, buildings and every part thereof in the city, and all cellars and passages of every sort, and inspect the safety and sanitary condition, and make plans, drawings and descriptions thereof according to the regulations of the department. The owner or his agent or representative, and the lessee or occupant of every tenement-house or part thereof, and every person having the care and management thereof, shall at all times, when required by any of such officers or persons, give them free access to such house and every part thereof.

Sec. 1344f. **Punishment for false returns and deceptive reports.** Any inspector, officer or employee of such tenement-house department who shall knowingly make thereto a false or deceptive report or statement in connection with his duties, or shall accept or receive any bribe or other compensation as a condition of or an inducement for not faithfully discovering or fully reporting or otherwise acting in accordance with his duty in any respect, or shall accept or receive any gratuity from any person whose interests may be affected by his official action, shall be guilty of a misdemeanor and punishable by imprisonment for not more than one year and by a fine of not more than five hundred dollars. If such officer, inspector or employee be convicted of such offence, he shall forfeit his office, and in addition all compensation due or to become due from such department.

Sec. 1344g. **Falsely personating an officer.** If any person, not an officer, inspector or employee of such department, or acting under the authority thereof, falsely represents himself as such, or if any such person shall use, wear or display, without authority, any shield or other insignia or emblem such as is worn by such an officer, inspector or employee, he shall be guilty of a misdemeanor.

Sec. 1344h. **Application of provisions of chapter nineteen.** The provisions of chapter nineteen of this charter, relative to the department of health, which provide:

1. For the repair of buildings.

2. For proceedings relative to dangerous and improperly constructed buildings.

3. For assistance and co-operation of the police department.

4. Punishment for violations of orders and the service of such orders.

5. For legal proceedings and punishment for disobedience of orders and ordinances.

6. For reimbursements and lien of expenses incurred by such department in the execution of its orders as contained in title five thereof.

7. For suits for the abatement or removal of nuisances, and for proceedings, and the powers and duties of such department in respect to such nuisances, and the definition of the word "nuisance" and other matters in respect thereto, shall apply to the supervision and regulation of tenement-houses by the tenement-house department, its officers, agents and employees, unless otherwise specified in, or inconsistent with, the provisions of this chapter.

Records and Reports; Miscellaneous Provisions.

Sec. 1344i. **Records in department.** The tenement-house commissioner shall provide a system for keeping the records of tenement-houses by card catalogue and street number, or otherwise. Such records shall include:

1. A diagram of each tenement-house, showing the shape of the building, its width and depth, also the measurements of the unoccupied area, showing shafts, courts, yards and other open spaces. Such diagram shall include a diagram of the second or typical floor of the building, showing the sizes and arrangement of the rooms and all doors, stairs, windows, halls and partitions.

2. A statement of the date or the approximate date when the building was erected.

3. The deaths occurring in the tenement-house during each year and the annual death-rate therein. Such statement shall show whether such deaths were of adults or children, and, if occasioned by tuberculosis, typhoid fever, diptheria, scarlet fever, smallpox, measles, or by any other contagious or infectious disease, it shall state the disease causing death.

4. The cases of sickness occurring in the tenement-house and the nature of the disease. Such record shall also show whether such cases of sickness were of children or adults.

5. The arrest of persons residing in the tenement-house.

Sec. 1344j. **Reports from different institutions and departments.** All dispensaries and hospitals in The City of New York shall make weekly statements to the tenement-house department as to the cases of sickness received in such hospital or treated in such dispensary from each tenement-house. Such statement shall show

the location of the tenement-house, by street and number, from which the case was received, and the nature of the sickness treated, whether the patient was an adult or child and the date of the treatment.

The police department of The City of New York shall furnish to the tenement-house department a weekly statement of the number of arrests of persons living in tenement-houses, which shall show the location of the tenement-house, by street and number, the offence with which the person is charged, the age and name of the offender, and such other information as the tenement-house department may require. The tenement-house commissioner shall prescribe and furnish blank forms for making such statements.

Sec. 1344k. **Other reports to the department.** Such department may require reports and information of such facts relative to the condition of persons residing in tenement-houses, as the commissioner may deem to be useful in carrying out the purposes of this chapter and the tenement-house laws, regulations and ordinances, from all dispensaries, hospitals, charitable or benevolent societies, infirmaries, prisons and schools, and from the managers, principals and officers thereof; the managers, principals and officers of such institutions shall promptly give such information and make such reports, verbal or in writing, as may be required by the commissioner.

Sec. 1344n. **Details of men to assist tenement-house department.** The police commissioner, upon the requisition of the tenement-house commissioner, shall detail to the service of said tenement-house department, for the purpose of the enforcement of the acts relating to tenement-houses, suitable officers and men of experience of at least five years' service in the police force; provided, that the number of officers and men so detailed shall not at any time exceed one hundred; and provided further, that the tenement-house department shall pay monthly to the police department a sum equal to the pay of all officers and men so detailed. These officers and men shall belong to the sanitary company of police, and shall report to the tenement-house commissioner. In making such detail the police commissioner shall give preference to those officers and men who have belonged for not less than five years to the sanitary company of the police assigned to the department of health. All other officers and men so detailed shall, when ever the tenement-house commissioner so requests, be selected

from those who have passed a competitive civil-service examination for their qualification for this service. The tenement-house commissioner may report back to the police department for punishment any member of said company guilty of any breach of order or discipline, or of neglecting his duty, and thereupon the police commissioner shall detail another officer or man in his place, and the discipline of the members of the sanitary company shall be in the jurisdiction of the police department, but at any time the tenement-house commissioner may object to any member of said sanitary company on the ground of inefficiency, and thereupon another officer or man shall be detailed in his place.

III.

RULES AND REGULATIONS FOR PLUMBING, DRAINAGE, WATER-SUPPLY AND VENTILATION OF BUILDINGS OF THE DEPARTMENT OF BUILDINGS OF THE CITY OF NEW YORK.

I.

Definition of Terms.

1. The term "private sewer" is applied to main sewers that are not constructed by and under the supervision of the department of sewers.

2. The term "house-sewer" is applied to that part of the main drain or sewer extending from a point two feet outside of the outer wall of the building, vault or area, to its connection with public sewer, private sewer or cesspool.

3. The term "house-drain" is applied to that part of the main horizontal drain and its branches inside the walls of the building, vault or area, and extending to and connecting with the house-sewer.

4. The term "soil-pipe" is applied to any vertical line of pipe extending through roof, receiving the discharge of one or more water-closets, with or without other fixtures.

5. The term "waste-pipe" is applied to any pipe, extending through roof, receiving the discharge from any fixtures except water-closets.

6. The term "vent-pipe" is applied to any special pipe provided to ventilate the system of piping and to prevent trap siphonage and back pressure.

II.

Materials and Workmanship.

7. All materials must be of the best quality, free from defects, and all work must be executed in a thorough, workmanlike manner.

8. All cast-iron pipes and fittings must be uncoated, sound, cylindrical and smooth, free from cracks, sand holes and other de-

fects, and of uniform thickness and of the grade known in commerce as "extra heavy."

9. Pipe, including the hub, shall weigh not less than the following average weights per linear foot:

Diameters.	Weights Per Linear Foot.
2 inches	5½ pounds.
3 "	9½ "
4 "	13 "
5 "	17 "
6 "	20 "
7 "	27 "
8 "	33½ "
10 "	45 "
12 "	54 "

10. The size, weight and maker's name must be cast on each length of the pipe.

11. All joints must be made with picked oakum and molten lead and be made gas-tight. Twelve (12) ounces of fine, soft pig lead must be used at each joint for each inch in the diameter of the pipe.

12. All wrought-iron and steel pipes must be equal in quality to "standard," and must be properly tested by the manufacturer. All pipe must be lap-welded. No plain black or uncoated pipe will be permitted.

13. Wrought-iron and steel pipes must be galvanized, and each length must have the weight and maker's name stamped on it.

14. Fittings for vent-pipes on wrought-iron and steel pipes may be the ordinary cast or malleable steam and water fittings.

15. Fittings for waste or soil and refrigerator waste-pipes must be the special extra heavy cast-iron recessed and threaded drainage fittings with smooth interior water-way and threads tapped, so as to give a uniform grade to branches of not less than one-fourth of an inch per foot. All fittings for wrought-iron or steel pipe must be galvanized.

16. All joints to be screwed joints made up with red lead, and the burr formed in cutting must be carefully reamed out.

17. Short nipples on wrought-iron or steel pipe, where the unthreaded part of the pipe is less than one and one-half inches long,

must be of the thickness and weight known as "extra heavy" or "extra strong."

18. The pipe shall not be less than the following average thickness and weight per linear foot:

Diameters.	Thicknesses.	Weights Per Linear Foot.
1½ inches	.14 inches.	2.68 pounds.
2 "	.15 "	3.61 "
2½ "	.20 "	5.74 "
3 "	.21 "	7.54 "
3½ "	.22 "	9.00 "
4 "	.23 "	10.66 "
4½ "	.24 "	12.34 "
5 "	.25 "	14.50 "
6 "	.28 "	18.76 "
7 "	.30 "	23.27 "
8 "	.32 "	28.18 "
9 "	.34 "	33.70 "
10 "	.36 "	40.06 "
11 "	.37 "	45.02 "
12 "	.37 "	48.98 "

19. All brass pipe for soil, waste and vent pipes and solder nipples must be thoroughly annealed, seamless, drawn, brass tubing, of standard iron-pipe gauge.

20. Connections on brass pipe and between brass pipe and traps on iron pipe must not be made with slip joints or couplings. Threaded connections on brass pipe must be of the same size as iron pipe threads for same size of pipe and be tapered.

21. The following average thicknesses and weights per linear foot will be required:

Diameters.	Thicknesses.	Weights Per Linear Foot.
1½ inches	.14 inches.	2.84 pounds.
2 "	.15 "	3.82 "
2½ "	.20 "	6.08 "
3 "	.21 "	7.92 "
3½ "	.22 "	9.54 "
4 "	.23 "	11.29 "
4½ "	.24 "	13.08 "
5 "	.25 "	15.37 "
6 "	.28 "	19.88 "

22. Brass ferrules must be best quality, bell-shaped, extra heavy cast brass, not less than four inches long and two and one-quarter, three and one-half inches, and four and one-half inches in diameter, and not less than the following weights:

Diameters.	Weights.
$2\frac{1}{4}$ inches	1 pound 0 ounces.
$3\frac{1}{2}$ "	1 " 12 "
$4\frac{1}{2}$ "	2 " 8 "

23. One and one-half inch ferrules are not permitted.

24. Soldering nipples must be heavy cast brass or of brass pipe, iron-pipe size. When cast they must not be less than the following weights:

Diameters.	Weights.
$1\frac{1}{2}$ inches	0 pounds 8 ounces
2 "	0 " 14 "
$2\frac{1}{2}$ "	1 " 6 "
3 "	2 " 0 "
4 "	3 " 8 "

25. Brass screw caps for cleanouts must be extra heavy, not less than one-eighth of an inch thick. The screw cap must have a solid square or hexagonal nut, not less than one inch high, with a least diameter of one and one-half inches. The body of the cleanout ferrule must be at least equal in weight and thickness to the calking ferrule for the same size of pipe.

26. Where cleanouts are required by rules and by the approved plans, the screw cap must be of brass. The engaging parts must have not less than six threads of iron-pipe size and be tapered. Cleanouts must be of full size of trap up to four inches in diameter, and not less than four inches for larger traps.

27. The use of lead pipes is restricted to the short branches of the soil- and waste-pipes, bends and traps, roof connections of inside leaders. "Short branches" of lead pipe shall be construed to joints.

5 feet of $1\frac{1}{2}$-inch pipe.
4 feet of 2-inch pipe.
2 feet of 3-inch pipe.
2 feet of 4-inch pipe.

28. All connections between lead pipes and between lead and

brass or copper pipes must be made by means of "wiped" solder joints.

29. All lead waste-, soil-, vent- and flush-pipes must be of the best quality, known in commerce as "D," and of not less than the following weights per linear foot:

Diameters.	Weights Per Linear Foot.
1¼ inches (for flush pipes only)	2½ pounds
1½ "	3 "
2 "	4 "
3 "	6 "
4 and 4½ inches	8 "

30. All lead traps and bends must be of the same weights and thicknesses as their corresponding pipe branches. Sheet lead for roof flashings must be six-pound lead and must extend not less than six inches from the pipe and the joint made water-tight.

31. Copper tubing when used for inside leader roof connections must be seamless drawn tubing, not less than 22-gauge, and when used for roof flashings must be not less than 18-gauge.

III.

General Regulations.

32. The entire plumbing and drainage system of each building must be entirely separate and independent of that of any other building.

33. Each building must be separately and independently connected with a public or private sewer, or cesspool.

34. Every building must have its sewer connections directly in front of the building, unless permission is otherwise granted by the commissioner of buildings.

35. Where there is no sewer in the street or avenue, and it is possible to construct a private sewer to connect in an adjacent street or avenue, a private sewer must be constructed. It must be laid outside the curb, under the roadway of the street.

36. Cesspools and privy-vaults will be permitted only after it has been shown to the satisfaction of the commissioner of buildings that their use is absolutely necessary.

37. When allowed, they must be constructed strictly in accord-

ance with the terms of the permit issued by the commissioner of buildings.

38. Cesspools must not be used as privy-vaults. Cesspools and privy-vaults must be at least twenty-five feet from any building and should be on the same lot with the building for which its use is intended. Cesspools and privy-vaults when constructed of brick must be eight inches thick; of stone, twenty inches thick.

39. All cesspools and privy-vaults must be made water-tight.

40. As soon as it is possible to connect with a public sewer, the owner must have the cesspool and privy-vault emptied, cleaned and disinfected, and filled with fresh earth, and have a sewer connection made in the manner herewith prescribed.

41. All pipe-lines must be supported at the base on brick piers or by heavy iron hangers from the cellar-ceiling beams, and along the line by heavy iron hangers at intervals of not more than ten feet.

42. All pipes issuing from extension or elsewhere, which would otherwise open within thirty feet of the window of any building, must be extended above the highest roof and well away and above all windows.

43. The arrangement of all pipes must be as straight and direct as possible. Offsets will be permitted only when unavoidable.

44. All pipes and traps should, where possible, be exposed to view. They should always be readily accessible for inspection and repairing.

45. In every building where there is a leader connected to the drain, if there are any plumbing fixtures, there must be at least one four (4) inch pipe extending above the roof for ventilation.

IV.

Yard, Area and Other Drains.

46. All yards, areas and courts must be drained.

47. Tenement-houses and lodging-houses must have their yards, areas and courts drained into the sewer.

48. These drains, when sewer-connected, must have connections not less than three inches in diameter. They should be controlled by one trap—the leader trap if possible.

49. Cellar drains will be permitted only where they can be connected to a trap with a permanent water seal.

50. Subsoil drains should discharge into a sump or receiving-

tank, the contents of which must be lifted and discharged into the drainage system above the cellar bottom by some approved method. Where directly sewer-connected, they must be cut off from the rest of the plumbing system by a brass flap valve on the inlet to the catch-basin, and the trap on the drain from the catch-basin must be water-supplied, as required for cellar drains.

51. Floor or other drains will only be permitted when it can be shown to the satisfaction of the commissioner of buildings that their use is absolutely necessary and arrangements made to maintain a permanent water seal in the traps.

V.

Leaders.

52. All buildings shall be kept provided with proper metallic leaders for conducting water from the roofs in such manner as shall protect the walls and foundations of said buildings from injury. In no case shall the water from said leaders be allowed to flow upon the sidewalk, but the same shall be conducted by pipe or pipes to the sewer. If there be no sewer in the street upon which such buildings front, then the water from said leaders shall be conducted by proper pipe or pipes below the surface of the sidewalk to the street gutter.

53. Inside leaders must be made of cast iron, wrought iron or steel, with roof connections made gas- and water-tight by means of a heavy lead or copper-drawn tubing wiped or soldered to a brass ferrule or nipple calked or screwed into the pipe.

54. Outside leaders may be of sheet metal, but they must connect with the house-drain by means of a cast-iron pipe extending vertically 5 feet above the grade level.

55. Leaders must be trapped with cast-iron running traps so placed as to prevent freezing.

56. Rain-water leaders must not be used as soil, waste or vent pipes, nor shall any such pipe be used as a leader.

VI.

The House-sewer, House-drain, House-trap and Fresh-air Inlet.

57. Old house-sewers can be used in connection with the new buildings or new plumbing only when they are found, on examination by the plumbing inspector, to conform in all respects to the requirements governing new sewers.

58. When a proper foundation, consisting of a natural bed of earth, rock, etc., can be obtained, the house-sewer can be of earthenware pipe.

59. Where the ground is made or filled in, or where the pipes are less than three feet deep, or in any case where there is danger of settlement by frost or from any cause, the house-sewer must be of extra heavy cast-iron pipe, with lead-calked joints.

60. The house-drain and its branches must be of extra heavy cast iron, when underground, and of extra heavy cast iron or galvanized wrought iron or steel when above ground.

61. The house-drain must properly connect with the house-sewer at a point two feet outside of the outer front vault or area wall of the building. An arched or other proper opening must be provided for the drain in the wall to prevent damage by settlement.

62. If possible, the house-drain must be above the cellar floor. The house-drain must be supported at intervals of ten feet by eight-inch brick piers or suspended from the floor beams, or be otherwise properly supported by heavy iron-pipe hangers at interval of not more than ten feet. The use of pipe hooks for supporting drains is prohibited.

63. No steam-exhaust, boiler blow-off or drip-pipe shall be connected with the house-drain or sewer. Such pipes must first discharge into a proper condensing tank, and from this a proper outlet to the house-sewer outside of the building must be provided. In low-pressure steam systems the condensing tank may be omitted, but the waste connection must be otherwise as above required.

64. The house-drain and house-sewer must be run as direct as possible, with a fall of at least one-quarter inch per foot, all changes in direction made with proper fittings, and all connections made with Y branches and one-eighth and one-sixteenth bends.

65. The house-sewer and house-drain must be at least four inch in diameter where water-closets discharge into them. Where rain water discharges into them the house-sewer and house-drain up to the leader connections must be in accordance with the following table:

Diameter.	Fall ¼-inch Per Foot.	Fall ½-inch Per Foot.
6 inches.......	5,000 sq. ft.	7,500 sq. ft. of drainage of area.
7 "	6,900 "	10,300 " "
8 "	9,100 "	13,600 " "
9 "	11,600 "	17,400 " "

66. Full size Y and T branch fittings for handhole cleanouts must be provided where required on house-drain and its branches.

67. An iron running trap must be placed on the house-drain near the wall of the house, and on the sewer side of all connections, except a drip-pipe where one is used. If placed outside the house or below the cellar floor, it must be made accessible in a brick manhole, the walls of which must be eight inches thick, with an iron or flagstone cover. When outside the house it must never be less than three feet below the surface of the ground.

The house-trap must have two cleanouts with brass screw-cap ferrules calked in.

68. A fresh-air inlet must be connected with the house-drain just inside of the house-trap, where under ground it will be of extra heavy cast iron. Where possible it will extend to the external air, and finish with an automatic device, approved by the department of buildings, at a point just outside the front wall of building. The fresh-air inlet must be of the same size as the drain up to four inches. For five- and six-inch drains it must be not less than four inches in diameter. For seven- and eight-inch drains not less than six inches in diameter, or its equivalent, and for large drains not less than eight inches in diameter, or its equivalent.

The curb inlet and the return-bend inlet are hereby prohibited.

VII.

Soil- and Waste-pipes.

69. All main soil-, waste- or vent-pipes must be of iron, steel or brass.

70. When they receive the discharge of fixtures on any floor above the first, they must be extended in full calibre at least one foot above the roof coping, and well away from all shafts, windows, chimneys or other ventilating openings. When less than four inches in diameter, they must be enlarged to four inches at a point not less than one foot below the roof surface by an increaser not less than nine (9) inches long.

71. No caps, cowls or bends shall be affixed to the top of such pipe.

72. In tenement-houses and lodging-houses wire baskets must be securely fastened into the opening of each pipe that is in an accessible position.

73. Necessary offsets above the highest fixture branch must not be made at an angle of less than 45 degrees to the horizontal.

74. Soil- and waste-pipes must have proper Y branches for all fixture connections.

75. No connection to lead branches for water-closets or slop-sinks will be permitted, except the required branch vent.

76. Branch soil- and waste-pipes must have a fall of at least one-quarter inch per foot.

77. Short TY branches will be permitted on vertical pipes only. Long one-quarter bends and long TYs are permitted. Short one-quarter bends and double hubs, short roof increasers and common offsets, and bands and saddles are prohibited.

78. The diameters of soil- and waste-pipes must not be less than those given in the following tables :

Main soil-pipes	4	inches
Main soil-pipes for water-closets on five or more floors	5	"
Branch soil-pipes	4	"
Main waste-pipes	2	"
Main waste-pipes for kitchen sinks on five or more floors	3	"
Branch waste-pipes for laundry tubs	1½	"
When set in ranges of three or more	2	"
Branch waste for kitchen sinks	2	"
Branch waste for urinals	2	"
Branch waste for other fixtures	1½	"

VIII.

Vent-pipes.

79. All traps must be protected from syphonage and back-pressure, and the drainage system ventilated by special lines of vent-pipes.

80. All vent-pipe lines and main branches must be of iron, steel or brass. They must be increased in diameter and extended above the roof as required for waste-pipes. They may be connected with the adjoining soil or waste line well above the highest fixture, but this will not be permitted when there are fixtures on more than six floors.

81. All offsets must be made at an angle of not less than forty-five degrees to the horizontal, and all lines must be connected at

the bottom with a soil- or waste-pipe or the drain in such a manner as to prevent the accumulation of rust-scale.

82. Branch vent-pipes should be kept above the top of all connecting fixtures, to prevent the use of vent-pipes as soil- or waste-pipes. Branch vent-pipes should be connected as near to the crown of the trap as possible.

83. Earthenware traps for water-closets and slop-sinks must be ventilated from the branch soil- or waste-pipe just below the trap, and this branch vent-pipe must be so connected as to prevent obstruction, and no waste-pipe connected between it and the fixture. Earthenware traps must have no vent-horns.

84. No sheet metal, brick or other flue shall be used as a vent-pipe.

85. The sizes of vent-pipes throughout must not be less than the following:

For main vents and long branches, two inches in diameter; for water-closets on three or more floors, three inches in diameter; for other fixtures on less than seven floors, two inches in diameter; three-inch vent pipe will be permitted for less than nine stories; for more than eight and less than sixteen stories, four inches in diameter; for more than fifteen and less than twenty-two stories, five inches in diameter; for more than twenty-one stories, six inches in diameter; branch vents for traps larger than two inches, two inches in diameter; branch vents for traps two inches or less, one and one-half inches in diameter.

For fixtures other than water-closets and slop-sinks, and for more than eight (8) stories, vent-pipes may be one (1) inch smaller than above stated.

IX.

Traps.

86. No form of trap will be permitted to be used unless it has been approved by the board of buildings.

87. Every fixture must be separately trapped by a water-sealing trap placed as close to the fixture outlet as possible.

88. A set of wash-trays may connect with a single trap, or into the trap of an adjoining sink, provided both sink and tub waste outlets are on the same side of the waste line, and the sink is nearest the line. When so connected the waste-pipe from the wash-trays must be branched in below the water seal.

89. The discharge from any fixture must not pass through more than one trap before reaching the house-drain.

90. All traps must be well supported and set true with respe t to their water levels.

91. All fixtures other than water-closets and urinals must have strong metallic strainers or bars over the outlets to prevent obstruction of the waste-pipe.

92. All exposed or accessible traps, except water-closet traps, must have brass trap-screws for cleaning the trap placed on the inlet side, or below the water level.

93. All iron traps for house-drain, yard and other drains and leaders must be running traps with handhole cleanouts of full size of the traps when same are less than five (5) inches. All traps underground must be made accessible by brick manholes with proper covers.

94. Overflow pipes from fixtures must in all cases be connected on the inlet side of traps.

95. All earthenware traps must have heavy brass floor-plates soldered to the lead bends and bolted to the trap flange, and the joint made gas-tight with red or white lead. The use of rubber washers for floor connections is prohibited.

96. No trap shall be placed at the foot of main soil- and waste-pipe lines.

97. The sizes for traps must not be less than those given in the following table:

Traps for water-closets....................	4	inches in diameter
Traps for slop-sinks......................	2	"
Traps for kitchen-sinks....................	2	"
Traps for wash-trays......................	2	"
Traps for urinals.........................	2	"
Traps for other fixtures..................	1½	"

Traps for leaders, areas, floor and other drains must be at least 3 inches in diameter.

X.

Safe and Refrigerator Waste-pipes.

98. Safe and refrigerator waste-pipes must be of galvanized iron, and be not less than one and one-quarter (1¼) inch in diameter, with lead branches of the same size, with strainers over the inlets secured by a bar soldered to the lead branch,

99. Safe waste-pipes must not connect directly with any part of the plumbing system.

100. Safe waste-pipes must either discharge over an open, water-supplied, publicly-placed, ordinarily-used sink, placed not more than three and one-half feet above the cellar floor.

101. The safe waste-pipe from a refrigerator must be trapped at the bottom of the line only and cannot discharge upon the ground or floor. It must discharge over an ordinary portable pan, or over some properly-trapped, water-supplied sink, as above. In no case shall the refrigerator waste-pipe discharge over a sink located in a room used for living purposes.

102. The branches on vertical lines must be made by Y fittings, and be carried up to the safe with as much pitch as possible.

103. Lead safes must be graded and neatly turned over bevel strips at their edges.

104. Where there is an offset on a refrigerator waste-pipe in the cellar, there must be cleanouts to control the horizontal part of the pipe.

105. In tenement-houses and lodging-houses the refrigerator waste-pipes must extend above the roof, and must not be larger than one and one-half inches, nor the branches smaller than one and one-quarter inches.

106. Refrigerator waste-pipes, except in tenement-houses, and all safe waste-pipes, must have brass flap-valves at their lower ends.

XI.

107. In tenement-houses, lodging-houses, factories, workshops and all public buildings, the entire water-closet apartment and side walls to a height of sixteen inches from the floor, except at the door, must be made waterproof with asphalt, cement, tile, metal or other waterproof material as approved by the board of buildings.

108. In tenement-houses and lodging-houses the water-closet and urinal apartments must have a window opening to the outer air, except that tenement- or lodging-houses three stories or less in height may have such window opening on a ventilating shaft not less than ten square feet in area.

109. In all buildings the outside partition of such apartment must extend to the ceiling or be independently ceiled over, and

these partitions must be air-tight. The outside partitions must include a window opening to outer air on the lot whereon the building is situated, or some other approved means of ventilation must be provided. When necessary to properly light such apartments, the upper part of the partitions must be made of glass. The interior partitions of such apartments must be dwarfed partitions.

110. The general water-closet accommodations for a tenement- or lodging-house cannot be placed in the cellar.

111. No water-closet can be placed outside of a building.

112. The closets must be set open and free from all enclosing woodwork.

113. Where water-closets will not support a rim seat, the seat must be supported on galvanized-iron legs, and a drip-tray must be used.

114. Every earthenware closet in all new work and in all alterations where it is not impossible to use it because of water-pipes or other obstructions, must be set on a natural stone slab. Sand or artificial stone or tile will not be allowed.

115. All water-closets must have earthenware flushing-rim bowls; "pipe-wash" bowls or hoppers will not be permitted.

116. Pan, valve, plunger, offset-washout and other water-closets having an unventilated space, or whose walls are not thoroughly washed at each discharge, will not be permitted.

117. Long hoppers will not be permitted, except where there is an exposure to frost.

118. The connections of traps must be made to main soil-, waste- or vent-pipe, by means of lead-calked or screwed joints. Drip-trays must be enamelled on both sides and secured in place.

119. In all sewer-connected occupied buildings there must be at least one water-closet, and there must be additional closets so that there will never be more than 15 persons per closet.

120. In tenement-houses and lodging-houses there must be one water-closet on each floor, and when there is more than one family on a floor, there will be one additional water-closet for every two additional families.

121. In lodging-houses where there are more than 15 persons on any floor, there must be an additional water-closet on that floor for every 15 additional persons or fraction thereof.

122. Water-closets and urinals must never be connected directly with or flushed from the water-supply pipes.

123. Water-closets and urinals must be flushed from separate cisterns on each floor, the water from which is used for no other purposes.

124. The overflow of cisterns may discharge into the bowls of the closet, but in no case connect with any part of the drainage system.

125. Iron water-closet and urinal cisterns and automatic water-closet and urinal cisterns are prohibited.

126. The copper lining of water-closet and urinal cisterns must not be lighter than ten (10) ounce copper.

127. Water-closet flush-pipes must not be less than one and one-fourth inches and urinal flush-pipes one (1) inch in diameter, and if of lead must not weigh less than two and one-half pounds and two pounds per linear feet. Flush couplings must be of full size of the pipe.

128. Latrine's trough water-closets and similar appliances may be used only on written permit from the said commissioner of buildings, and must be set and arranged as may be required by the terms of the permit.

129. All urinals must be constructed of materials impervious to moisture that it will not corrode under the action of urine. The floor and wall of the urinal apartments must be lined with similar non-absorbent and non-corrosive material.

130. The platforms or treads of urinal stalls must never be connected independently to the plumbing system, nor can they be connected to any safe waste-pipe.

131. Iron trough water-closets and trough urinals must be enamelled or galvanized.

132. In tenement-houses and lodging-houses sinks must be entirely open, on iron legs or brackets, without any enclosing woodwork.

133. Wooden washtubs are prohibited. Cement or artificial stone tubs will not be permitted unless approved by the board of buildings.

XII.

Water-supply for Fixtures.

134. All water-closets and other plumbing fixtures must be provided with a sufficient supply of water for flushing, to keep them in a proper and cleanly condition.

135. When the water-pressure is not sufficient to supply freely and continuously all fixtures, a house-supply tank must be provided, of sufficient size to afford an ample supply of water to all fixtures at all times. Such tanks must be supplied from the pressure or by pumps, as may be necessary; when from the pressure, ball-cocks must be provided.

136. If water-pressure is not sufficient to fill house-tank, power pumps must be provided for filling them in tenement-houses, lodging-houses, factories and workshops.

137. Tanks must be covered so as to exclude dust, and must be so located as to prevent water contamination by gas and odors from plumbing fixtures.

138. House supply-tanks must be of wood or iron, or of wood lined with tinned and planished copper.

139. House-tanks must be supported on iron beams.

140. The overflow-pipe should discharge upon the roof, where possible, and in such cases should be brought down to within six (6) inches of the roof, or it must be trapped and discharged over an open and water-supplied sink not in the same room, not over 3½ feet above the floor. In no case shall the overflow be connected with any part of the plumbing system.

141. Emptying pipes for such tanks must be provided, and be discharged in the manner required for overflow-pipes, and may be branched into overflow-pipes.

142. No service-pipes or supplying-pipes should be run, and no tanks, flushing cisterns or water-supplied fixtures should be placed where they will be exposed to frost.

143. Where so placed they shall be properly packed and boxed in such a manner as to prevent freezing.

XIII.

Testing the Plumbing System.

144. The entire plumbing and drainage system within the building must be tested by the plumber, in the presence of a plumbing inspector, under a water or air test, as directed. All pipes must remain uncovered in every part until they have successfully passed the test. The plumber must securely close all openings as directed by the inspector of plumbing. The use of wooden plugs for this purpose is prohibited.

145. The water test will be applied by closing the lower end of the main house-drain and filling the pipes to the highest opening above the roof with water. The water test shall include at one time the house-drain and branches, all vertical and horizontal soil, waste and vent and leader lines and all branches therefrom to point above the surface of the finished floor and beyond the finished face of walls and partitions. Deviation from the above rule will not be permitted, unless upon written application to and approval by the commissioner of buildings. If the drain or any part of the system is to be tested separately, there must be a head of water at least six feet (6) above all parts of the work so tested, and special provision must be made for including all joints and connections in at least one test.

146. The air test will be applied with a force-pump and mercury columns under ten pounds pressure, equal to twenty inches of mercury. The use of spring gauges is prohibited.

147. After the completion of the work, when the water has been turned on and the traps filled, the plumber must make a peppermint or smoke test in the presence of a plumbing inspector and as directed by him.

148. The material and labor for the tests must be furnished by the plumber. Where the peppermint test is used, two ounces of oil of peppermint must be provided for each line up to five stories and basement in height, and for each additional five stories or fraction thereof, one additional ounce of peppermint must be provided for each line.

IV.

DISINFECTANTS AND METHODS OF DISINFECTION AS RECOMMENDED BY THE DEPARTMENT OF HEALTH OF THE CITY OF NEW YORK.

DISINFECTION AND DISINFECTANTS.

Sunlight, pure air and cleanliness are always very important agents in maintaining health and in protecting the body against many forms of illness. When, however, it becomes necessary to guard against such special dangers as accumulated filth or contagious diseases, disinfection is also essential. In order that disinfection shall afford complete protection, it must be thorough, and perfect cleanliness is better, even in the presence of contagious disease, than poor disinfection.

All forms of fermentation, decomposition, and putrefaction, as well as the infectious and contagious diseases, are caused by minute living germs. The object of disinfection is to kill these germs. Decomposition and putrefaction should at times be prevented by the immediate destruction or removal from the neighborhood of the dwelling, of all useless putrescible substances. Impure air, especially air from sewers, cesspools, putrefactive matter, etc., causes conditions in man which are very favorable to the contraction of contagious diseases.

In order that the sick room shall be readily kept clean and as free as possible from the germs causing the infectious diseases, it is important that all articles not necessary for immediate use in the care of the sick person, especially upholstered furniture, carpets, curtains and bric-a-brac, should be removed from the room to be occupied by the sick person. If another room has already been occupied, it must, of course, be disinfected.

AGENTS FOR CLEANSING AND DISINFECTION.

Too much emphasis cannot be placed upon the importance of sunlight, fresh air and cleanliness, both as regards the person,

the dwelling and its surroundings, in preserving health and protecting the body from all kinds of disease. Sunlight and fresh air should be freely admitted through open windows, and personal cleanliness should be attained by frequently washing the hands and body.

Cleanliness in dwellings, and in all places where men go, may under ordinary circumstances be well maintained by the use of the three following solutions:

1. *Soap-suds Solution.*—For simple cleansing, or for cleansing before or after the methods of disinfection by chemicals described below, one ounce of common washing soda should be added to twelve quarts of hot soap (soft soap) and water.

2. *Strong Soda Solution.*—This, which is a stronger and more effective cleansing solution, is made by dissolving one-half pound of common washing soda in three gallons of hot water. This solution thus obtained should be applied by scrubbing with a hard brush.

3. *Weak Soda Solution.*—This is made by dissolving one ounce of common washing soda in twelve quarts of hot water.

When it becomes necessary to arrest putrefaction or to prevent the spread of contagious diseases by killing the living germs which cause them, more powerful agents must be employed than those required for simple cleanliness, and these are called disinfectants. The following are some of the most reliable disinfectants:

4. *Heat.*—Complete destruction by fire is the best method of disposing of infected articles of small value; but continued high temperatures not as great as that of fire will destroy all forms of life. Thus, boiling or steaming in closed vessels for one-half hour, or boiling in the Weak Soda Solution in open vessels for the same time, will destroy all disease germs. Dry heat is not so effective a germ destroyer as moist heat, except at much higher temperatures, which will destroy or injure many combustible materials.

5. *Carbolic Acid Solution—Lysol-Creolin.*—Dissolve six ounces of carbolic acid in one gallon of hot water. This makes approximately a five per cent. solution of carbolic acid, which, for many purposes, may be diluted with an equal quantity of water. Great care must be taken that the pure acid does not come in contact with the skin, as it is very corrosive. The commercial colored impure carbolic acid should not be used in watery solutions as it contains a large percentage of cresol, which is insoluble in water

and has, therefore, little value. The two alkaline solutions of cresol, named lysol and creolin, are strong disinfectants and non-corrosive and can be used in place of the solutions of carbolic acid of equal strength.

6. *Bichloride Solution* (bichloride of mercury or corrosive sublimate).—Dissolve sixty grains of pulverized corrosive sublimate and two tablespoonfuls of common salt in one gallon of hot water. This makes approximately a 1 to 1000 solution. This solution must be kept in glass, earthen or wooden vessels (not in metal vessels), and is not to be used for disinfecting metal articles.

The Carbolic and Bichloride Solutions are very poisonous when taken by the mouth, but are harmless when used externally.

7. *Milk of Lime.*—This mixture is made by adding one quart of dry freshly slaked lime to four or five quarts of water. (Lime is slaked by pouring a small quantity of water on a lump of quicklime. The lime becomes hot, crumbles, and as the slaking is completed a white powder results. The powder is used to make Milk of Lime). Air-slaked lime has no value as a disinfectant.

8. *Dry Chloride of Lime.*—This must be fresh and kept in closed vessels or packages. It should have the strong pungent odor of chlorine.

Chlorinated Lime Solution.—This solution is made by adding six ounces of fresh chloride of lime, having a strong odor of chlorine, to one gallon of water. It must be well mixed and should be prepared one hour before using. This solution, when fresh, is a reliable disinfectant and deodorizer.

9. *Formalin.*—This is a 40 per cent. solution of formaldehyde gas in water. It is, in a 5 per cent. solution, an efficient disinfectant and deodorizer. A method which gives fairly efficient results, is to hang large cloths (sheets) in the room and sprinkle or spray them with formalin, as recommended by the Chicago Health Department. For each 1,000 cubic feet of space in the room, 10 ounces of formalin should be used.

10. *Sulphurous Acid Gas,* i.e., the gas produced by burning sulphur, is a fairly efficient germicide under certain definite conditions. These conditions are, in brief, that all the germs should be freely exposed to the gas in a tightly closed room for at least eight hours, that the air of the room should be moist, and that the amount of gas should be that generated by burning at least three pounds of sulphur for every 1,000 cubic feet of air space.

The proprietary disinfectants which are so often widely advertised, and whose composition is kept secret, are relatively expensive and often unreliable and inefficient. It is important to remember that substances which destroy or disguise bad odors are not necessarily disinfectants.

NOTE.—The cost of the Carbolic Solution is much greater than that of the other solutions, but generally this solution is to be much preferred. When the cost is an important element, the Bichloride Solution may be substituted for all purposes for which the Carbolic Solution is recommended, except for the disinfection of discharges, eating utensils and articles made of metal, and of clothing, bedding, etc., which is very much soiled. Its poisonous character must be kept constantly in mind.

METHODS OF DISINFECTION IN INFECTIOUS AND CONTAGIOUS DISEASES.

The most important diseases to be guarded against by disinfection are Scarlet Fever, Measles, Diphtheria, Tuberculosis (Consumption), Smallpox, Typhoid and Typhus Fevers, Yellow Fever and Cholera.

1. *Hands and Person.*—Dilute the Carbolic Acid, Lysol or Creolin Solutions with an equal amount of water, or use the Bichloride Solution without dilution. Hands soiled in caring for persons suffering from contagious diseases, or soiled portions of the patient's body, should be immediately washed with one of these solutions, and then thoroughly washed with soap and water. The nails should always be kept perfectly clean with a brush or nail-cleaner. Before eating, the hands should be first washed in one of the above solutions, then thoroughly scrubbed with soap and water by means of a brush, and finally dipped again in the disinfectant.

2. *Soiled Clothing, Towels, Napkins, Bedding, etc.*, should be immediately immersed, in the sick-room, in boiling water for one half hour, or in the Carbolic Solution for twelve hours. They can then be wrung out and washed in the usual way. Articles such as beds, woollen clothing, etc., which cannot be washed, should be referred to the Health Department for disinfection or destruction.

3. *Food and Drink.*—Food thoroughly cooked and drinks that

have been boiled are free from disease germs. Food and drinks, after cooking or boiling, if not immediately used, should be placed when cool in clean dishes or vessels and covered. In presence of an epidemic of Cholera or Typhoid Fever, milk and water used for drinking, cooking, washing dishes, etc., should always be boiled before using, and when Cholera is prevalent all persons should avoid eating uncooked fruit, fresh vegetables and ice.

4. *Discharges of all kinds, from the Mouth, Nose, Bladder and Bowels* of patients suffering from contagious diseases, should be received into glass or earthen vessels containing the Carbolic Solution or Milk of Lime, or they should be removed on pieces of cloth, which are immediately burnt or immersed in one of these solutions. Special care should be observed to disinfect at once the vomited matter and the intestinal discharges from Cholera patients, as these alone contain the dangerous germs. In Typhoid Fever the intestinal discharges and urine, and in Diphtheria, Measles and Scarlet Fever the discharges from the throat and nose all bring about infection and should be treated in the same manner. The volume of the solution used to disinfect discharges should be, with the Carbolic Solution, at least twice as great as that of the discharge, or with Milk of Lime from four to five times as great. After standing for an hour or more, the disinfecting solution, with the discharges, may be thrown into the water-closet. Cloths, towels, napkins, bedding, or clothing soiled by the discharges must be at once placed in the Carbolic Solution and the hands of the attendants disinfected as described above. In convalescence from Measles and Scarlet Fever the scales from the skin (peeling) are also carriers of infection. To prevent the dissemination of disease by means of these scales, the skin should be carefully washed daily in warm water and soap. The external use of vaseline for the same purpose is recommended. After use, the soapsuds should be thrown into the water-closet and the vessel rinsed out with Carbolic Solution.

The ordinary house filtration of water does not remove all the germs of disease, and cannot be depended upon to render the water safe in time of danger.

The intestinal discharges (feces) need special treatment on account of the difficulty with which the disinfectant fluids penetrate to all portions. To thoroughly disinfect a mass of feces, it is necessary to add to it double its amount of one of the strong disinfect-

ing solutions and allow it to soak for twelve hours. If desired to hasten the process, the fecal matter covered by a carbolic acid or formalin solution can be thoroughly mixed with the disinfectant, allowed to stand for one hour or thoroughly disinfected by boiling for thirty minutes.

5. *The Sputum from Consumptive Patients.*—The importance of the proper disinfection of the sputum (expectoration) from consumptive patients is little understood. Consumption is a contagious disease, and is always the result of transmission from the sick to the healthy or from animals to man. The sputum contains the germs which cause the disease, and in great majority of cases is the source of infection. After being discharged, unless properly disposed of, it may become dry and pulverized and float in the air as dust. This dust contains the germs and is the common cause of the disease through inhalation. In all cases, therefore, the sputum should be disinfected when discharged. It should be received into covered cups containing the Carbolic, Lysol, or Formalin Solutions. Handkerchiefs soiled by it should be burned or soaked in the Carbolic Solution and then boiled. Dust from the walls, mouldings, pictures, etc., in rooms that have been occupied by consumptive patients, contains the germs, and will produce tuberculosis in animals when used for their inoculation. Therefore, rooms should be thoroughly disinfected before they are again occupied. Rooms in which consumptives are living should never be dusted with a dry cloth or brush, but should always be cleaned by wiping furniture, mantels, etc., with a damp cloth. This should afterward be burnt or disinfected by soaking in the Carbolic or Chlorinated Lime Solution, or by boiling in the Weak Soda Solution for half an hour. Carpets should be swept with a broom wrapped in a damp cloth, the latter being afterward disinfected as above. If the sputum of all consumptive patients were destroyed at once when discharged, a large proportion of the cases of the disease would be prevented.

6. *Closets, Kitchen and Hallway Sinks, etc.*—Each time the closet is used for infected discharges, one pint of the Carbolic Solution should be poured into the pan (after it is emptied) and allowed to remain there. All discharges should be disinfected before being thrown into the closet. Sinks should be flushed at least once daily.

7. *Dishes, Knives, Forks, Spoons, etc.,* used by a patient should

be kept for his exclusive use, and not removed from the room. They should be boiled or washed first in the Carbolic Solution, then in hot Soap-suds, and finally rinsed in hot water. These washing fluids should afterward be thrown into the water-closet. The remains of the patient's meals may be burned or thrown into a vessel containing one of the disinfectant solutions and allowed to stand for one hour before being thrown away.

8. *Rooms and their Contents.*—Rooms which have been occupied by persons suffering from contagious disease should not be again occupied until they have been thoroughly disinfected by the Health Department and renovated by the owner. For this purpose either careful fumigation with sulphur or formaldehyde gas will be employed, or one of these combined with the following procedure: Carpets, curtains and upholstered furniture which have been soiled by discharges, or which have been exposed to infection in the room during the illness, will be removed for disinfection by steam. Woodwork, floors and plain furniture will be thoroughly washed with the Soap-suds and Bichloride Solutions.

Books, leather articles and those which are readily discolored, will be removed by the Department and disinfected by exposing them for 12 hours to formaldehyde vapor in a small chamber.

9. *Rags, Clothes and Articles of Small Value,* which have been soiled by discharges or infected in other ways, should be burned.

10. *In Case of Death,* the body should be completely wrapped in several thicknesses of cloth wrung out of the Carbolic or Bichloride Solution and placed in an hermetically sealed coffin.

If notified, the Department of Health of New York City will disinfect rooms and their contents without cost to the tenant, after the rooms have been vacated by persons convalescent from any contagious disease. Notification should be sent to the Chief Inspector of Contagious Diseases, Sixth Avenue and Fifty-fifth Street. Telephone Call, No. 1204 Columbus.

It is important to remember that an *abundance of fresh air, sunlight and absolute cleanliness* not only helps protect the attendants from infection, but also aids in the recovery of the sick. Sunlight is one of the most effective disinfectants known, killing all germs directly exposed to it within a few hours.

METHODS OF CLEANLINESS AND DISINFECTION TO PREVENT THE OCCURRENCE OF ILLNESS.

1. *Water-closet Bowls and all Receptacles for Human excrement* should be kept perfectly clean by frequent flushing with a large quantity of water, and as often as necessary disinfected with the Carbolic or Chlorinated Lime Solutions. The woodwork around and beneath them should be frequently scrubbed with the hot Soap-suds Solution.

2. *Sinks and the Woodwork around and the floor beneath them* should be frequently and thoroughly scrubbed with the hot Soap-suds Solution.

3. *School Sinks.*—School sinks should be thoroughly flushed with a large quantity of water at least twice daily, and should be carefully cleaned twice a week or oftener by scrubbing. Several quarts of the Carbolic or Chlorinated Lime Solutions should be frequently thrown in the sink after it has been flushed.

4. *Cesspools and Privy Vaults.*—An abundance of Milk of Lime, Dry Chloride of Lime or Chlorinated Lime Solution (at least four times the amount of the excreta to be disinfected), should be thrown into these daily, and their contents should be frequently removed.

5. *Cellars and Rooms in Cellars* are to be frequently whitewashed, and, if necessary, the floors sprinkled with fresh, dry Chloride of Lime. *Areas and Paved Yards* should be cleaned, scrubbed, and, if necessary, washed with the Bichloride Solution. *Street Gutters and Drains* should be cleaned, and when necessary sprinkled with Chloride of Lime or washed with Milk of Lime.

6. *Air Shafts.*—Air shafts should be first cleaned thoroughly, and then whitewashed. To prevent tenants throwing garbage down air shafts, it is advisable to put wire netting outside of windows opening on shafts. Concrete or asphalt bottoms of shafts should be cleaned and washed with the Bichloride Solution, or sprinkled with Chloride of Lime.

7. *Hydrant Sinks, Garbage Receptacles, and Garbage and Oyster-shells Shutes and Receptacles* should be cleaned daily, and sprinkled with dry Chloride of Lime.

8. *Refrigerators and the Surfaces around and beneath them, Dumb-waiters,* etc., may be cleaned by scrubbing them with the hot Soap-suds Solution.

9. *Traps.*—All traps should be flushed daily with an abundance of water. If at any time they become foul, they may be cleaned by pouring considerable quantities of the hot Strong Soda Solution into them, followed by the Carbolic Solution.

10. *Urinals and the Floors around and underneath them* should be cleaned twice daily with the hot Soap-suds Solution, and in addition to this, if offensive, they may be disinfected with the Carbolic Solution.

11. *Stable Floors and Manure Vaults.*—Stable floors should be kept clean and occasionally washed with the hot Soap-suds, or the hot Strong Soda Solution. Powdered fresh Chloride of Lime may be used in manure vaults.

12. *Vacant Rooms* should be frequently aired.

13. *The Woodwork in School-houses* should be scrubbed weekly with hot Soap-suds. This refers to floors, doors, door-handles, and all woodwork touched by the scholars' hands.

14. *Spittoons in all Public Places,* should be emptied daily and washed with the hot Weak Soda or Soap-suds Solution, after which a small quantity of the Carbolic Solution or Milk of Lime should be put in the vessel to receive the expectoration.

15. *Elevated and Surface Cars, Ferry-boats and Public Conveyances.*—The floors, door-handles, railings and all parts touched by the hands of passengers should be washed frequently with the hot Weak Soda or Soap-suds Solution. Slat-mats from cars, etc., should be cleaned by scrubbing with a stiff brush in the hot Soap-suds Solution.

Use of Bromine Solution as a Deodorant.

Slaughter-houses, Butchers' Ice-boxes and Wagons, Trenches, Excavations, Stable Floors, Manure Vaults, Dead Animals, Offal, Offal Docks, etc., may be deodorized by a weak Solution of Bromine which is a valuable agent for this purpose. The Bromine Solution, however, is only temporary in its action, and must be used repeatedly. It should be applied by sprinkling. Although somewhat corrosive in its action on metals, it is otherwise harmless.

The Solution of Bromine must be prepared with great care, as the pure bromine from which it is made is dangerous. It is very caustic when brought in contact with the skin; it is volatile and its fumes are extremely irritating if inhaled. In preparing this

solution in large quantities, a pound bottle of bromine should be dropped into a barrel containing forty or fifty gallons of water, and then broken under water with an iron bar. The solution is completed by thoroughly stirring. To prepare a smaller quantity an ounce bottle of bromine may be dropped into a pail containing three or four gallons of water, and broken in the same way and with the same care.

Conclusion.

The general principles of disinfection outlined in this circular may be applied for the disinfection of all articles not specifically treated of, and which are similar in character to those considered.

V.

MILK INSPECTION.

EXTRACT FROM A PAPER BY DR. HERMAN BETZ, CHIEF INSPECTOR DIVISION OF FOOD AND OFFENSIVE TRADES INSPECTION OF THE DEPARTMENT OF HEALTH, NEW YOKR.

The milk-inspector is on duty, technically, all the time; he may be called upon at any hour, day or night, Sundays as well as on week-days, for it is obvious that a dishonestly inclined milk-dealer, who behaves himself during the week, should not be left under the impression that he can do as he pleases on Sunday.

The milk-inspector is obliged to spend from 9 A.M. to 4 P.M. in actual inspections, after which he writes out a daily report of every place visited by him during the day, giving the time by hour and minute, the name and address of the milk-dealer, the permit number under which the dealer does business, and the temperature and lactometer standing of the milk so examined.

The report must be in the Chief Inspector's hands by 9 A.M. each day. On Monday morning a weekly report also is handed in giving the number of inspections made each day, as well as the total number for the week, his attendance at court, and arrests and fines also must be carefully recorded.

The following instruments and utensils are supplied to the milk-inspector, which he carries about with him in a suitable satchel:

A lactometer; a thermometer (dairy style); a cylinder of tin in which to float the lactometer; lead seals and wire for sealing sample-bottles of milk; one seal punch with two dies, one impressing the lead with "Health Department, Manhattan," the other with the inspector's letter which has been given him for his identification as A, B, C, or D, etc.; a writing diamond, to mark sample-bottles; six-ounce bottles with two holes in neck opposite each other, through which the wire is passed holding the

cork immovable, unless the seal and wire are disturbed, for dealer's sample; four-ounce bottles for samples of milk for analysis at laboratory; one box of labels, gummed on back, for marking above sample with inspection number, sample number and lactometer standing at 60° F.; a book of 50 labels to mark dealer's sample, as also a stub corresponding with same, which is afterward attached to the analysis report; a book in which is reported the year, month, day, hour and minute when inspection is made, the number of inspection, the name and address of the dealer, number of years in business, number of quarts sold per day, number of permit under which business is done, name and address of the wholesale milk-dealer from whom he receives his supply, the gross and net lactometer standing and the temperature of the milk examined, also physical properties, odor, taste and appearance, the name of person present when examination is made, whether proprietor of store or representative, and, lastly, the mark which is found on top of cover of milk-can.

The mode of inspection is as follows: When an inspector enters a place where milk is sold he announces this fact to the proprietor of the place, or his representative. After he has satisfied himself that the milk is properly cooled and utensils for measuring are clean, he stirs the milk thoroughly, fills a tin cylinder within two inches of the rim, leaving room for displacement by lactometer; the lactometer is then carefully lowered into the milk, care being taken that the stem is dry. While the lactometer is allowed to come to rest, the thermometer is used to carefully note the temperature, this and the lactometer's reading are carefully entered in the inspection-book and for every three degrees of temperature below 60° F. one degree is deducted on the lactometer, or added if the temperature is above 60° F. Should the milk present a good appearance and stand somewhere between 108 and 112° on the lactometer at 60° F., the milk-inspector will pronounce the milk good, but if the milk should stand below 108 or above 112° net on the lactometer, and not be of good physical appearance, he will consider the milk suspicious and proceed to take a sample from same.

A six-ounce bottle is filled up within a short space below the neck to allow sufficient room for expansion and the cork forced in well below the two perforations mentioned above. A wire is then passed through the orifice in the bottle, forced

through the cork and out through the opposite perforation in the bottle, and then wound twice around the neck of the bottle and over the groove in the lead-seal, which is then forced down over the wire by the punch until it presents a quite flat appearance with the imprint on both sides, as described above, and from which the wire cannot be removed without destroying the seal and imprint. The sample is then labelled with the part of page which corresponds with the stub described, and which is gummed on the reverse side. Both stub and label are counterparts of each other bearing number of inspection, date, name and address of dealer, reason for taking sample, inspector's name and the number of sample. This bottle is then sealed and labelled as described above, and handed to the dealer or his representative, to be held by him, or to be given to a chemist for analysis if he so chooses. This is now done but seldom, dealers, both wholesale and retail, are so convinced of the absolute correctness with which analyses are made at the Department laboratory, that they usually instruct their lawyers to concede the analysis. The four-ounce square bottle is now filled with some of the same milk, and to this is attached a square stick-label bearing inspection and sample number, as well as inspector's letter described before. The inspector now proceeds to the laboratory of the Department. When he arrives there he will hand the sample bottle to the chemist or assistant chemist in charge, who will sign a receipt for same on a ticket made out by the milk-inspector, on which are again given the milk-dealer's permit number, year, month, day, hour and minute of inspection, but the space for the milk-dealer's name and address is left blank for the time being; the ticket also gives the wholesale dealer's name and address from whom the retailer receives his supply, and the number of specimens of milk examined, their standing both by lactometer, thermometer, and net, also physical appearance. As this ticket is used by the inspector on the stand in trials to refresh his memory, it is made out with great care, and gives in addition to the above facts the recorded numbers of the instruments used, for it has happened in some important trials that the correctness of the instruments has been questioned. For this reason, as soon as a lot of lactometers or thermometers is received from the manufacturer, they are carefully tested in our laboratory; if they come up to the standard they are accepted, numbered, and the record of the same is kept

at the Chief Inspector's office; if they are found to vary perceptibly they are rejected. The same ticket also records the fact whether the can from which the sample has been taken was wired, the amount of milk the can contained, the fact that the milk had been stirred by the proprietor or his representative, the marks found on shoulder and cover of can, the location of the can in the store or place in which the milk was sold; whether the can contained a dipper, whether this inspection was made on the regular routine inspection or upon a complaint from a citizen, the total number of cans examined at that particular inspection, the name of the witness present at the time of inspection, and also a space in which to record the date on which the warrant was obtained. In case of prosecution the number of the City Magistrate's Court, the date, when, and the amount of bail obtained, and, finally, the Court in which the case was tried and the amount of fine paid or the disposition of the case, whether dismissed altogether or sentence suspended. All this is recorded on the front of the ticket; on the reverse side is given, first, the receipt of the chemist for the sample, then the analysis as follows:

Water, per cent.; total solids, per cent.; fat, per cent.; solids not fat, per cent.; per cent. low in solids; per cent. low in fat; borax, present or absent; salicylic acid, present or absent; formaldehyde, present or absent; reaction, acid or alkaline.

The name of the assistant chemist who has performed the analysis is also given and is countersigned by the chemist. This completes the ticket, as far as the inspector can complete it, at that particular stage. The ticket, with the stub, is then handed to the clerk in charge of milk analyses in the Chief Inspector's office, which ends the milk-inspector's duty for the present as far as this particular sample is concerned. The clerk in charge of milk analyses, just mentioned, enters up all the facts given in a book in which spaces are provided for all the facts given above; the ticket is then placed in an envelope with others which may come in on the same day, giving the exact time when received from the inspectors, when forwarded to the laboratory and when received back again. After forty-eight hours the analysis is finished, and the chemist will then fill up the space provided for percentages of water, total solids, fat, etc., and whether the milk has been found unadulterated or short in total solids or fat, giving the exact amount. The ticket is then immediately returned by

the chemist to the clerk in charge of milk analysis, who enters up all the various facts found by the chemist and then fills in the name and address of dealer from the stub. The ticket is now ready for the Chief Inspector, who will determine by the percentage of fat or total solids shortage whether an arrest is to be made or not. The rule followed at present is that the dealer is to have the benefit of the doubt up to four per cent. of solids and nine per cent. of fat, but if the shortage is five per cent. or over in total solids, or a shortage of ten per cent. or over of fat, prosecution is at once to be started; such tickets are, therefore, signed by the Chief Inspector and stamped "Arrest" or "Do not arrest," and after the ticket has been countersigned by the Sanitary Superintendent the clerk in charge of milk analyses will notify the milk-inspector that a ticket is awaiting him at the office for arrest. The milk-inspector upon receipt of the ticket prepares an affidavit of the facts in the case, and asks for a warrant for the milk-dealer's arrest in the City Magistrate's Court in whose district the violation has taken place. This warrant is usually granted, and a day of hearing is set; the warrant is served by a court officer in as inoffensive a manner as possible; that is, by simply notifying the dealer that his presence is required in the court to which the officer is attached, for violation of the Sanitary Code by selling adulterated milk, and that probably it would be best for the dealer to bring with him a bondsman. At the day and hour set for the hearing the milk-inspector states his case and requests that the defendant be held under bond for trial in Special Sessions. The City Magistrate usually names a bail amount of $100, which the milk-dealer furnishes through a friend, or in many cases the wholesale dealer who has furnished the milk furnishes the bail. If the defendant is represented by counsel, the counsel frequently requests a hearing, but the outcome is usually the same. After a lapse of but a short time the case is set down for trial at Special Sessions, where the judges without exception have taken great interest in these milk cases; some of them even have taken the trouble to inform themselves of the various stages of analysis, being present during an actual analysis at the laboratory. They are well posted in relation to the provisions of the Sanitary Code and the agricultural laws of this State relating to milk and dairy matters, total solids, fat, solids not fat, the name of antiseptics and like terms and their meanings, which are usually

so puzzling to outsiders, and even lawyers who try these cases understand them as well as any chemist. It is directly due to this intimate knowledge of terms, facts and matters connected with the scientific part of milk analysis, and the recognition of the earnest efforts of the Health Department to improve the milk supply of the City of New York, that it has been able to carry on milk-inspection with satisfactory results; for what would all this work amount to did not the courts so ably and conscientiously carry out their part.

Since 1896 the Department of Health has required every dealer in milk to take out a permit, in order to better regulate the care of milk and enforce the Sanitary Code.

VI.

INSTRUCTIONS FOR MEDICAL SCHOOL INSPECTORS, OF THE HEALTH DEPARTMENT OF NEW YORK.

Inspectors are required to report at the schools to which they have been assigned from 8.50 to 9.30 A.M. every day that school sessions are held.

They are to carefully examine each child that has been isolated by the teachers in charge of the scholars, and cause to be excluded from school each one affected with or showing symptoms of any contagious or infectious disease, more especially the following: Measles, diphtheria, scarlet fever, croup, whooping cough, mumps, contagious eye diseases, parasitic diseases of the head or body, or chicken-pox. They shall furnish each pupil that is to be excluded with a printed card, upon which they shall note the date, name and location of the school; name, age and address of the child, and the reason for its exclusion. These cards, signed by the Medical School Inspectors, are to be taken home by the excluded pupils. Each day, before leaving a school, each Inspector is required to fill out a printed daily report blank, giving the date and time of visit; the name, location, district and card numbers of the school; the number of children examined (male, female and total), the full name, age and address of each one excluded, with the diagnosis of each excluded case. Note is also to be made on the daily report of any culture that has been taken, giving the clinical diagnosis and stating whether the pupil was excluded or not. On the last school day of each week the printed summary blank on the back of the daily report blank used that day is to be properly filled out for each school day of that week. Each day, as soon as possible after leaving the last school to be visited, Inspectors are required to mail a separate daily report (properly folded and "backed") for each school visited, to the Chief Inspector at the Central Office, where a daily summary is made of the work performed in all of the schools visited.

All children excluded from school for measles or scarlet fever are

visited at their homes within twenty-four hours by one of the Diagnosticians of the Board, and such cases are not tabulated as true ones unless he confirms the diagnosis, when a Department postal card is sent to the school, excluding the child until after its complete recovery, and when the necessary disinfection and fumigation of the rooms where it lives have been attended to, a certificate allowing it to return to school is issued.

Pupils excluded for chicken-pox are visited at their homes by the Medical Inspectors of the Division of Contagious Diseases having charge of the districts in which the children live; when they confirm the diagnosis, the cases are recorded as true ones, and the schools notified by Department postal cards.

In cases of suspicious diphtheria, when there is well-marked clinical evidence in the throat at the time of the examination, the child is to be excluded after a culture has been taken; when the clinical evidence is not well marked, a culture is to be taken, but the child is not to be excluded until a report is received by the Medical School Inspector from the Division of Bacteriology, stating that an examination of the culture shows the presence of the Klebs-Loeffler bacilli.

In each case, where an examination of a culture taken by a Medical School Inspector shows the presence of the Klebs-Loeffler bacilli, a notice to that effect is promptly mailed to the maker of the culture, and also to the Medical Inspector of the Division of Contagious Diseases in whose district the child resides, who then takes charge of the case as far as the proper isolation is concerned, taking subsequent necessary cultures, ordering disinfection and fumigation when the Klebs-Loeffler bacilli have disappeared from the throat, and issuing certificates for the child's return to school.

The District Medical Inspectors have the same surveillance over each case of measles or scarlet fever where the diagnosis made by the School Inspector has been confirmed by a Diagnostician. When the result of an examination of a culture made by a School Inspector is negative, a report to that effect is forwarded to the Chief Inspector, but not to the maker of the culture.

When the examination of a culture made by a School Inspector does not admit of an exact bacteriological diagnosis and a prompt confirmatory culture is requested, such request will be mailed to the maker of the culture, and also to the District Medical In-

spector, in order that a confirmatory culture may be taken—by the former, if the child is at school, or by the latter, if the child should be at home. All cultures made by the School Inspectors, accompanied by the "culture blanks," properly filled out and signed, should be promptly forwarded to the nearest culture station.

Children excluded on account of whooping cough, mumps, contagious eye diseases, parasitic diseases, etc., should be told to return when cured, and should be again examined before returning to their class-rooms; if not entirely well they should be again excluded.

The Inspectors shall ascertain from the principals and teachers of the schools the names and addresses of all children having contagious diseases in their families, where notification has not been sent to the schools by the Board of Health, and such lists shall be forwarded with the daily reports. Inspectors shall keep a daily record in a blank book, furnished for such purposes, of the number of children examined (male, female, and total), the full names, ages, residences and causes for exclusion of those excluded from school, and a list of cultures taken and forwarded.

If, by reason of illness or other cause, an Inspector is unable to report at a school, arrangements must be made with an Inspector of another school to act as a substitute, and the Chief Inspector informed of the facts without unnecessary delay.

If, in the opinion of an Inspector, immediate action should be taken by the Board of Health in any case, he should immediately communicate by telephone with the Chief Inspector.

Medical School Inspectors shall report at the Central Office once during each month, the time to be designated by the Chief Inspector. Exclusion cards for pupils, daily report blanks, addressed envelopes, blank books for recording the work performed, wooden tongue-depressors, culture outfits, and lists of culture stations, will be furnished at the office of the Chief Inspector.

The daily duties of Medical School Inspectors cease when they have mailed their reports, after leaving their schools. They are not, under any circumstances, to visit children at their homes, to prescribe for them, or suggest treatment at the schools. The treatment must be received from the family physicians, in the dispensaries, or in the hospitals.

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